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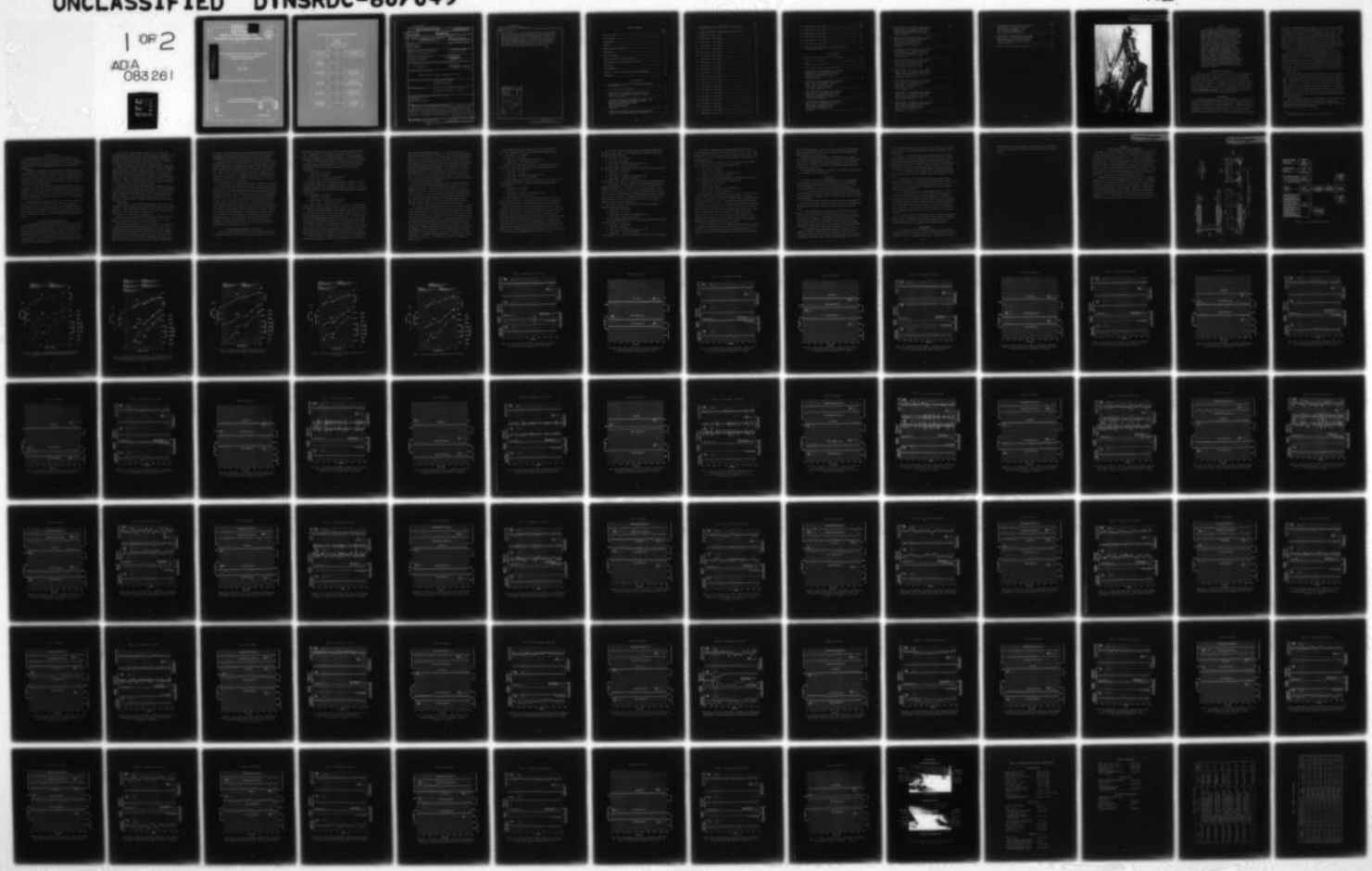

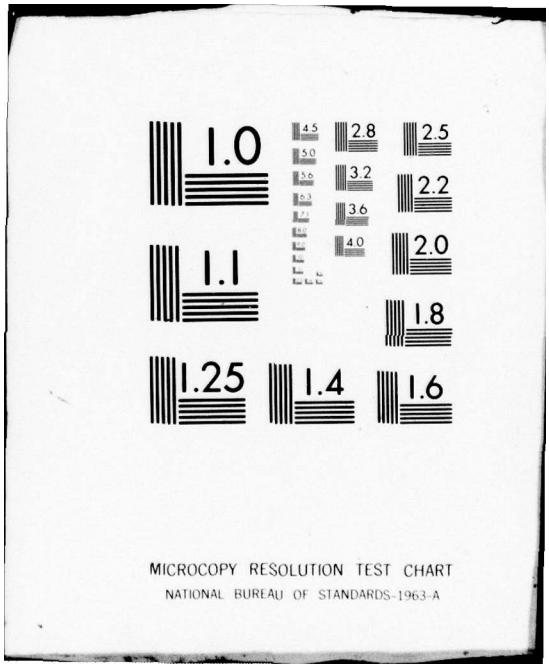
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STANDARDIZATION TRIALS OF THE STABLE SEMISUBMERGED PLATFORM, SSP KAIMALINO, WITH A MODIFIED BUOYANCY CONFIGURATION

by

Everett L. Woo
Jerry L. Mosch

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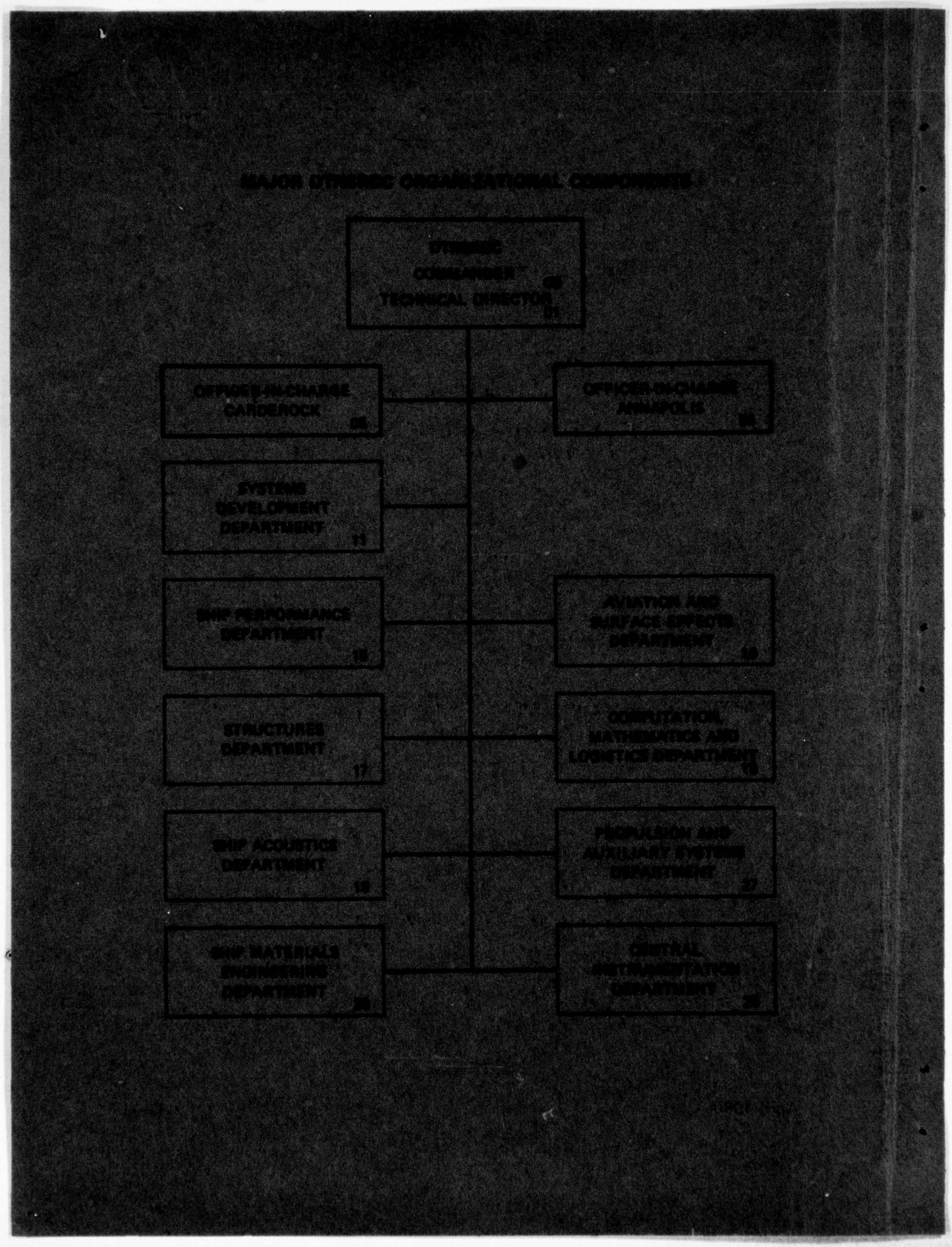
SHIP PERFORMANCE DEPARTMENT
RESEARCH AND DEVELOPMENT REPORT

April 1980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REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER (14) DTNSRDC-80/049	2. GOVT ACCESSION NO. AD-A083261
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle) (6) STANDARDIZATION TRIALS OF THE STABLE SEMISUBMERGED PLATFORM, SSP KAIMALINO, WITH A MODIFIED BUOYANCY CONFIGURATION.	5. TYPE OF REPORT & PERIOD COVERED (9) Final rept'g
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) (10) Everett L. Woo Jerry L. Mauck	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS David W. Taylor Naval Ship R&D Center Bethesda, Maryland 20084	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS Work Unit 1100-200
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Sea Systems Command Washington, DC 20362	12. REPORT DATE (11) April 1980 13. NUMBER OF PAGES 122
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) (12) 121	15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVED FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

(16) F43411

18. SUPPLEMENTARY NOTES

(17) SF4341121 1

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Standardization Trials
SSP KAIMALINO
Modified Buoyancy Module

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report contains the results of heavy, medium, and light displacements standardization trials conducted on the Stable Semisubmerged Platform (SSP) KAIMALINO in a new buoyancy module configuration. Measurements of shaft rpm, shaft torque, ship speed, ship's heading, position of ship's control surfaces, ship's roll, ship's pitch, and relative wind velocity and direction were made throughout the speed range of 4.68 to 17.96 knots. A comparison of power →

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characteristics of the old and the newly increased buoyancy configurations is presented. The new buoyancy scheme proved significantly superior below 13.2 knots and less desirable above that speed. Comparisons are made between the ship's automatic control system and a fixed control surfaces condition. No significant powering changes were noted. Comparisons between different nominal trim conditions were made which produced modest differences. Calm and nominally rough water trials were also compared and the effects of the sea state on powering characteristics was found to be minimal.

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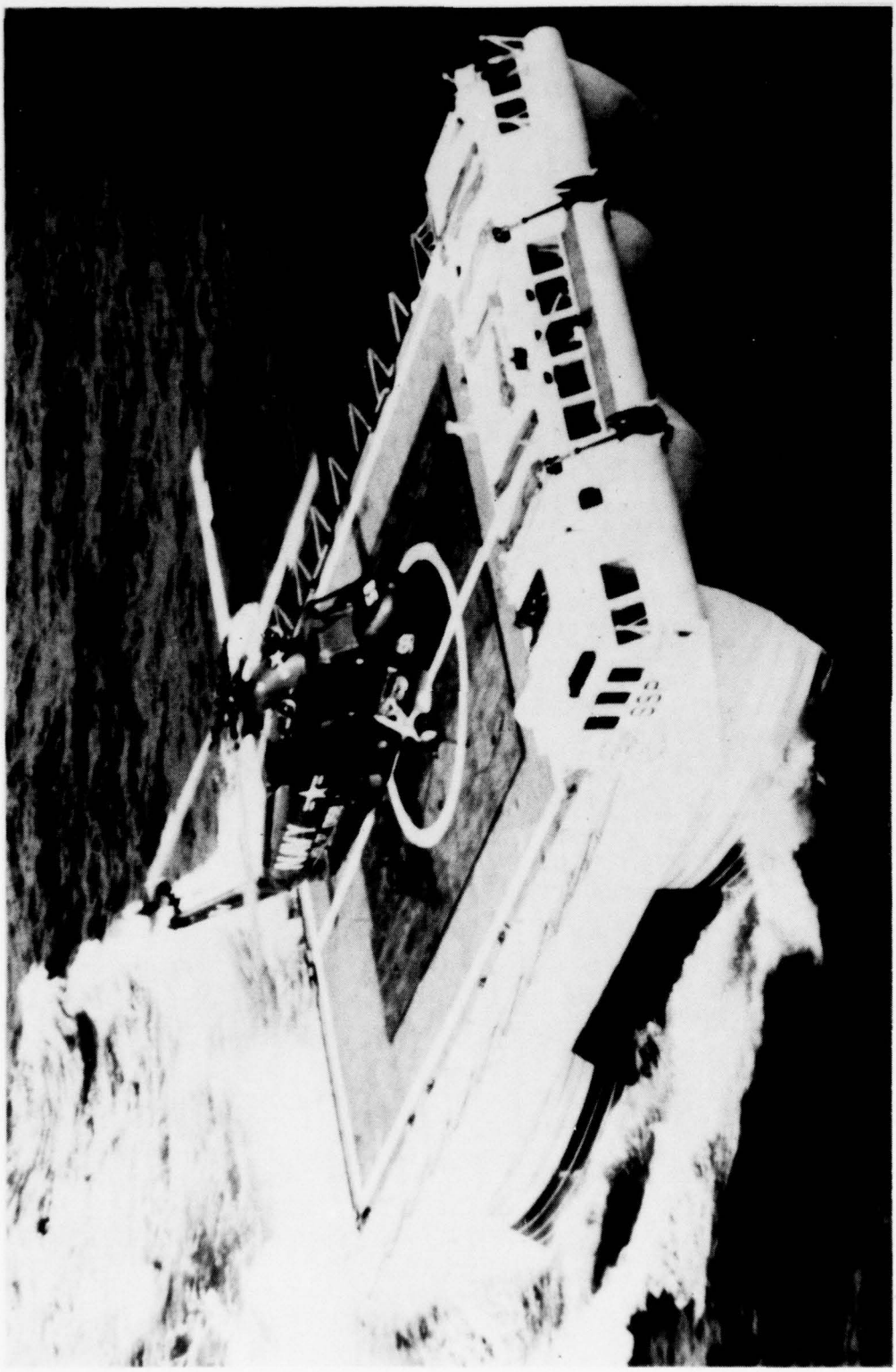

ABSTRACT

This report contains the results of heavy, medium, and light displacements standardization trials conducted on the Stable Semisubmerged Platform (SSP) KAIMALINO in a new buoyancy module configuration. Measurements of shaft rpm, shaft torque, ship speed, ship's heading, position of ship's control surfaces, ship's roll, ship's pitch, and relative wind velocity and direction were made throughout the speed range of 4.68 to 17.96 knots. A comparison of power characteristics of the old and the newly increased buoyancy configurations is presented. The new buoyancy scheme proved significantly superior below 13.2 knots and less desirable above that speed. Comparisons are made between the ship's automatic control system and a fixed control surfaces condition. No significant powering changes were noted. Comparisons between different nominal trim conditions were made which produced modest differences. Calm and nominally rough water trials were also compared and the effects of the sea state on powering characteristics was found to be minimal.

ADMINISTRATIVE INFORMATION

The work described herein was performed for the Small Waterplane Area Twin Hull (SWATH) Ship Development Office (Code 1110) in the Systems Development Department of the David W. Taylor Naval Ship Research and Development Center (DTNSRDC). This project was carried out under DTNSRDC Work Unit Number 1100-200. The funding source was the SWATH Ship Exploratory Development Program under the Ships, Submarines, and Boats Program Task Area SF 43411211, Task 19424. The Program Manager was Mr. James L. Schuler of the Naval Sea Systems Command (NAVSEA 031R).

INTRODUCTION

The Stable Semisubmerged Platform (SSP) KAIMALINO is a two-strut per hull, Small Waterplane Area Twin Hull (SWATH) ship operated by the Hawaii Laboratory of the Naval Ocean Systems Center (NOSC). Principal ship and propeller characteristics are shown in Figure 1 and Table 1. The present configuration of KAIMALINO differs from that of the original in that a buoyancy blister was added to each of the two submerged, parallel, torpedo-

shaped hulls. These submerged hulls support a cross-structure above water by means of four vertical, surface-piercing struts. Control of the vessel is by means of two canards (one at the forward end of each hull), a full-span stabilizing fin with two flaps located near the hull sterns, twin rudders, and two controllable, reversible pitch propellers (CRP). All control surfaces are hydraulically operated from the pilot house. The rudders operate in tandem while each canard and flap can be independently controlled. Propeller pitch is changed by mechanical rather than hydraulic means with control again being exercised from the pilot house.

Twin General Electric GE-T64 gas turbines located in the cross-structure are used in conjunction with the four-bladed, 6.5-ft (1.98-m) diameter Wilkinson CRP's. Each 2100 shaft horsepower (15.66 kW) rated engine is connected via a four tier chain-drive system to the propellers. An auxiliary diesel propulsion system, compatible with the gas turbine/chain-drive system, is utilized when getting underway and while maneuvering in port. This enables the gas turbines to be put on-line with the SSP already underway. Further description and details of the SSP can be found in Reference 1.*

Calm and nominally rough water standardization trials were conducted on SSP at the Fleet Operational Readiness Accuracy Check Site (FORACS) Range, Lualualei, Hawaii and in the ocean off the entrance to Kaneohe Bay, Hawaii, respectively. During the period 19 September through 2 October 1979, a series of standardization trials, each emphasizing a different variable's effect on the powering curves, was accomplished. The variables included the new buoyancy blister configuration, rough water, calm water, automatic control system, fixed control surfaces, statically 0-deg trim, statically trimmed by the stern, heavy displacement, medium displacement, and light displacement.

These trials were carried out by representatives of the David W. Taylor Naval Ship Research and Development Center (DTNSRDC), FORACS Range personnel, and Kentron Incorporated personnel under contract to the Naval Ocean Systems Command's Hawaii Laboratory.

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*A complete listing of references is given on page 111.

TRIAL CONDITIONS

The SSP standardization trials were conducted according to the schedule shown in Table 2. To ensure accurate base-line powering curves for the new buoyancy module configuration, Ḱentron, Inc. divers cleaned the underwater hulls and other appendages during the period 3 through 14 September 1979.

A propeller pitch survey was conducted and the full ahead and full astern pitches were determined to be 87.96 in (2.23 m) ahead and 29.06 in (0.74 m) astern for the starboard propeller. The port propeller pitch was 87.96 in (2.23 m) ahead and 29.85 in (0.76 m) astern. However, during operations, it was difficult to maintain full ahead propeller pitch due to the vagaries of the control system.

All of the trials were conducted with both propellers set to full ahead pitch. However, during some runs (see Tables 9 and 10, Run 480N), it was observed that the pitch on one or the other propeller would drop off as evidenced by reduced torque on the port shaft at the same rpm. When this occurred, adjustments were made in the pilot house to bring the propeller pitch back to full ahead.

Sea conditions were acceptable throughout the calm water trial period (State 0 to State 1 seas). Nominally rough water (State 2 sea) was encountered for the fifth and sixth days of trials. Normally a State 3 sea or above would be considered rough water for a standardization trial. The average true wind velocity for the standardization trials was 10 knots. A more in-depth look at the day-to-day trial conditions may be found in Table 3.

TRIAL PROCEDURES AND INSTRUMENTATION

The standardization trials were conducted in accordance with Chapter 094 of the Naval Ship's Technical Manual. Data were obtained from 4.68 to 17.96 knots for various conditions. Two to three runs, alternating in direction and of three minutes duration, were made at each speed. An average was applied to take into account the effects of current. For a three spot pass, the odd direction run was doubled and the four spots were then averaged. All runs were conducted with the propellers set at full ahead pitch, as previously mentioned.

The prior SSP standardization trials[2] utilized a fixed control surfaces method to achieve an initial even keel operation condition. Once the control surfaces were adjusted so that a nominally even keel was achieved, the run was conducted with the controls fixed. The majority of the runs reported herein were also conducted in this manner.

The SSP is presently equipped with an automatic control system with which some runs were conducted. This system takes inputs from a Humphrey Stable Table Package to improve dynamic stability. The Humphrey Stable Table Package was located on the bridge along the ship's centerline. It consisted of gyros and accelerometers on a stable table which generates a signal of the ship's six degrees of freedom (roll, pitch, heave, yaw, sway, and surge). A feedback control system was used to translate the signals into commands instigating control surface movement.

The automatic control system consisted of two operational modes; the platform mode and the contouring mode, respectively. In the platform mode, pitch and roll measurements taken from the Humphrey Stable Table were the inputs selected for the feedback control system. These two motions were kept to a minimum and hence improved the SSP's dynamic stability. The majority of the runs using the automatic control system were conducted in the platform mode.

A contouring mode, where pressure sensors along the hull below the waterline are used as inputs to the feedback control system, was the other alternative. These inputs enabled the SSP to follow the wave motion and maintain a selected hull depth in relation to the waves. This mode was utilized for one selected speed as a comparison.

Figure 2 is an instrumentation block diagram which shows how the raw data was obtained and utilized. A list of the channels recorded and appropriate levels of accuracy can be found in Table 4.

These data were recorded at a rate of 21 samples every two seconds by using a Hewlett-Packard (HP) digital acquisition system. This digital acquisition system employs a HP-2240A measurement and control processor that scans all the data and converts it into a digital format (excepting the range data which is output in a digital form) at preselected rates. These data are recorded on a flexible disc (HP-9885M) which has a high-speed (23 kbytes per second) and a large storage capacity (500,000 bytes).

This process is made functional by an HP-9835B desktop computer which was programmed to collect the data at certain rates and to perform various engineering conversions with the data before the data were recorded.

The torque data were obtained using strain gages that were bonded to the propulsion shafts. The torque signals were telemetered from the shafts using an ACUREX torque-strain monitoring system. The rpm signal for each shaft was generated by a magnetic pick-up mounted adjacent to a 60-tooth gear. This frequency signal was converted to an analog voltage with an F/V converter. Roll and pitch angles were taken from a DTNSRDC stabilization gyro that was mounted in a compartment adjacent to the bridge. These angles were converted from a three-phase, 60-cycle format to an analog voltage using solid state S/A converters.

Ship's heading was obtained from the ship's gyro mounted on the bridge. It is a single speed, three-phase, 60-cycle signal. It was converted to an analog voltage using a solid state S/A converter. Wind direction and speed were generated by a DTNSRDC furnished Bendix anemometer Model 120 that was laboratory calibrated. Ship's position was determined by using a Motorola Mini-Ranger III System (MRS III). The MRS III, operating on the principle of radar, uses a transmitter (located on the SSP) to interrogate the two reference station transponders (shore units). The elapsed time between the transmitted interrogation produced by the MRS III transmitter and the reply received from each transponder was used as the basis for determining the range to each transponder. This range information, together with the known location of each transponder, was triangulated to provide a position fix of the SSP for speed calculations. Wave height was recorded during the rough water runs. This signal came from a wave-rider buoy with a transmitter/receiver located on the SSP. The actual wave height was related to the heave motion of the buoy. This analog voltage output was proportioned to the significant wave height.

PRESENTATION AND DISCUSSION OF TRIAL RESULTS

The results of the standardization trials conducted on SSP KAIMALINO are presented in Figures 3 through 7 and tabulated in Tables 5 through 18.

The SSP was ballasted to achieve the static, in-harbor trim required each day. A comparison of this trim and the operational trim for each calm water run is presented in the Appendix (Table 19). These measurements should be acknowledged when reviewing the results of each day's operations.

Figure 3 is a comparison of the SSP original, non-blister hull and the blister module hull configurations. In the original hull configuration, Stenson[2] reports the following maximum powering performance characteristics.

1. Ship speed - 19.08 knots.
2. Shaft rpm - 307.8 rpm.
3. Shaft torque - 50,095 ft-lb (68,930 Nm).
4. Shaft power - 2,936 shp (2,190 kW).

The new blister module hull configuration proved, as expected, to produce a lower maximum ship speed for corresponding power. This was due to the increased displacement and correspondingly greater resistance. For similar operating conditions, SSP attained the following maximum power performance characteristics.

1. Ship speed - 17.95 knots.
2. Shaft rpm - 318.4 rpm.
3. Shaft torque - 56,810 ft-lb (77,020 Nm).
4. Shaft power - 3,445 shp (2,570 kW).

Hence, above the "hump" cross-over point of 13.2 knots, it took more power to achieve the same speed compared to the original, non-blister hull trial.

Both of these standardization trials utilized fixed control surfaces and were run in calm water. However, the blister module hull trial was run at a displacement of 226.7 tons (230.3 metric tons) as compared to the original hull displacement of 193.7 tons (196.8 metric tons). The effect of the additional displacement tended to decrease the speed range covered by the hump. No longer is it possible to achieve as great a speed range (10 to 13.5 knots versus 10 to 10.6 knots) for a minimal increase in power. For a speed of 10.3 knots, the blister module hull requires 7 percent less rpm, 31 percent less shaft horsepower, and 25 percent less shaft torque. However, powering levels at 13.2 knots for both conditions are comparable.

Figure 4 represents a comparison of how the statically trimmed by the stern heavy and light displacement conditions contrast with a statically

0-deg trim heavy displacement condition. All three trials were run in calm water utilizing fixed control surfaces. The ship speed hump occurred in the 9.7- to 11.6-knot range. In the hump region, the heavy displacement trimmed by the stern condition required 7 percent less shaft torque and shaft horsepower than the statically 0-deg trim condition. Below the hump, both heavy displacement curves are similar with the trimmed by the stern condition being marginally more desirable. The tailing off of the heavy displacement trimmed by the stern condition above 16 knots is due to the lower stabilizer control flap angles needed to keep the ship on an even keel. This can be observed in Tables 7 and 8 where it can be seen that at 12.84 and 14.46 knots, the stabilizer flap angles averaged 22.4 deg and 16.8 deg (trailing edge up), respectively.

As expected, less power was needed to achieve a desired speed when operating in the light displacement condition as compared to the heavy displacement condition. The heavy displacement trimmed by the stern condition required 9 percent more rpm, 33 percent more shaft horsepower, and 25 percent more shaft torque to develop a comparable speed in the 9.7- to 11.6-knot range. For the rest of the speed range above and below the hump, the light displacement trimmed by the stern condition generally required 6 percent less rpm, 19 percent less shaft horsepower, and 13 percent less shaft torque than its heavy displacement counterpart.

An attempt was made to determine the effect of 0-deg control surfaces versus fixed controls/level trim operation on the powering traits. Control surface angles were set at 0-deg in the pilot house but due to the fineness of the control system, it was not always possible to attain this condition. This can be seen in Tables 7 through 10. As can be seen in Figure 4, there was essentially little or no effect on the light displacement curve below 11.6 knots. With an approximate 10-deg difference in stabilizer flap angles, these points were in agreement with their fixed control surfaces counterparts. Higher speed, with resultant large stabilizer flap angles in the magnitude of 15 deg and higher, were not investigated at the light displacement condition. Deviation in the heavy displacement curve at 15 knots was due to the large 16.8-deg stabilizer control flap angle necessary to maintain an even keel. These control flap angles are tabulated in Tables 7 and 8.

The maximum powering point reached for the heavy displacement (237.1 tons, 240.9 metric tons), statically 0-deg trim condition was:

1. ship speed - 17.51 knots;
2. shaft rpm - 313.7 rpm;
3. shaft torque - 56,830 ft-lb (77,050 Nm); and
4. shaft power - 3,395 shp (2,530 kW).

Comparable powering traits for the heavy displacement (237.8 tons, 241.6 metric tons), statically trimmed by the stern condition were:

1. ship speed - 17.47 knots;
2. shaft rpm - 317.6 rpm;
3. shaft torque - 53,810 ft-lb (72,960 Nm); and
4. shaft power - 3,255 shp (2,425 kW).

The light displacement (217.4 tons, 220.9 metric tons) trimmed by the stern condition attained the following maximum powering performance characteristics:

1. ship speed - 17.83 knots;
2. shaft rpm - 315.5 rpm;
3. shaft torque - 51,490 ft-lb (69,810 Nm); and
4. shaft power - 3,095 shp (2,310 kW).

An additional speed of 4.7 knots was conducted using the auxiliary diesels to propel the SSP. This point appears to fall very nicely along the powering curve associated with the gas turbine mode of operation.

Figure 5 can be used as a guide for comparing the automatic control system and the fixed control surfaces operational method. Both trials were conducted in calm water after the ship was statically trimmed to 0-deg at dockside. Below 9.8 knots, the automatic control system proved less desirable, needing on the average 9 percent more rpm, 23 percent more shaft power, and 18 percent more shaft torque to achieve a speed comparable to one obtained using the fixed control surfaces approach. However, above 9.8 knots, there was only a 1 percent rpm difference and a 3 percent shaft power and shaft torque difference between the two operational modes. The automatic control system proved slightly more desirable in this speed range. Data for these runs are presented in Tables 5, 6, 11, and 12.

As can be seen from the following data, the maximum powering points reached are quite similar. For the fixed control surfaces (237.1 tons, 240.9 metric tons), this was:

1. ship speed - 17.51 knots;
2. shaft rpm - 313.7 rpm;
3. shaft torque - 56,830 ft-lb (77,050 Nm); and
4. shaft power - 3,395 shp (2,530 kW).

The automatic control system (237.8 tons, 241.6 metric tons) top spot was:

1. ship speed - 17.58 knots;
2. shaft rpm - 315.1 rpm;
3. shaft torque - 56,450 ft-lb (76,540 Nm); and
4. shaft power - 3,390 shp (2,530 kW).

On the average, there is only a 2 percent difference in the powering data.

A comparison of statically trimmed by the stern rough and calm water trials was accomplished. These results are portrayed in Figure 6 and tabulated in Tables 9, 10, 15, and 16. As can be seen from the curves, there is very little difference in the powering characteristics. This was due to the fact that the difference between rough and calm water was not as great as desired. However, it should be noted that the calm water trial did indeed evince the fact that it would take less power to achieve a speed in calm water than in rough water.

The calm water trials (217.4 tons, 220.9 metric tons) reached a maximum powering performance of:

1. ship speed - 17.83 knots;
2. shaft rpm - 315.5 rpm;
3. shaft torque - 51,490 ft-lb (69,810 Nm); and
4. shaft power - 3,095 shp (2,310 kW).

The maximum powering characteristics of the rough water trials (215.0 tons, 218.4 metric tons) were:

1. ship speed - 17.53 knots;
2. shaft rpm - 308.3 rpm;
3. shaft torque - 51,730 ft-lb (70,140 Nm); and
4. shaft power - 3,035 shp (2,265 kW).

On the average, only a 1 percent difference was found in the powering data.

A view of two trimmed by the stern medium displacement trials is shown in Figure 7 and tabulated in Tables 13, 14, 17, and 18. Due to the disparities in the trial conditions, no real comparison can be made. Each of these curves should be looked upon as two entirely independent sets of powering trials data.

The maximum powering characteristics for the fixed control surfaces (226.7 tons, 230.3 metric tons) calm water trial were:

1. ship speed - 17.95 knots;
2. shaft rpm - 318.4 rpm;
3. shaft torque - 56,810 ft-lb (77,020 Nm); and
4. shaft power - 3,445 shp (2,570 kW).

The maximum powering characteristics for the automatic control system (228.4 tons, 232.1 metric tons) rough water trial were:

1. ship speed - 17.83 knots;
2. shaft rpm - 321.0 rpm;
3. shaft torque - 56,610 ft-lb (76,750 Nm); and
4. shaft power - 3,460 shp (2,580 kW).

A wave profile run was conducted at the top speed. The data for this run are comparable to the rough water automatic control system data obtained. The purpose of this run was to compare the two operational modes of the automatic control system: the contouring and platforming modes, respectively. This particular run was unique in that the automatic control system in the contouring mode operated the control surfaces according to the wave profile. By utilizing heave pressure sensors mounted in the ship hulls, a constant hull depth in relation to the waves was possible. All other automatic control system runs in the platform mode used 0-deg operational trim as the criteria for control surface movement. This was achieved by the monitoring of the pitch and roll gyros in the Humphrey Stable Table and keeping these motions to a minimum.

Figures 8 through 37 are actual computer time histories of the various full-scale trial conditions. Depicted on these graphs are all the control surfaces: roll and pitch angles; relative wind speed and direction; significant wave height (where applicable); shaft rpm; and shaft torque.

For the calm water trials, a run with a speed just above the speed hump and a high-speed run were the two runs chosen to give a representative example of each day's operation.

Rough water trials are represented by showing each of the types of seas in which the SSP operated. For the rough water trials, powering data were found by averaging the port and starboard beam seas data together. Other types of seas were head, following, starboard bow quartering, and starboard stern quartering.

By observing these figures it is possible to determine the interaction of each variable on the powering data.

CONCLUSIONS

The results of the various standardization trials on SSP KAIMALINO are considered to be good and the data applicable to the new buoyancy module configuration of the SSP with clean hulls and propellers. The following conclusions can be drawn from the standardization trials.

1. The original non-blister hull configuration proved more desirable above the speed of 13.2 knots. However, below this speed, the new blister hull configuration is markedly superior in terms of power needed to achieve comparable speeds.

2. Operations using a statically trimmed by the stern configuration provided a 7 percent shaft torque and shaft power savings with essentially the same rpm over that of a statically 0-deg trim vessel in the hump region.

3. At low ship speeds, the SSP will trim naturally by the bow; at higher speeds (over the hump), the SSP will tend to trim by the stern. Between 12 and 16 knots, it is recommended that the SSP operate initially at a statically 0-deg trim. When operating in this speed range in a statically trimmed by the stern condition, large stabilizer flap angles were required to maintain level flight. Above and below this speed range, a statically trimmed by the stern condition appears to be beneficial.

4. As expected, light displacement statically trimmed by the stern required less power (on the average of 6 percent less shaft rpm, 19 percent less shaft power, and 13 percent less shaft torque) than its heavy displacement counterpart above and below the hump region of 9.7 to 11.6

knots. Even greater power savings of 9 percent less shaft rpm, 33 percent less shaft power, and 25 percent less shaft torque were realized in the hump region.

5. Little or no powering difference was observed between a 0-deg control surfaces status and a fixed control surfaces status for the light displacement at speeds below 11.6 knots. With an approximate 10-deg difference in stabilizer flap angles, these points were in agreement with their fixed-control surfaces counterpart. Major changes in operational trim did not occur until a speed of approximately 12 knots was obtained.

6. It is recommended that a further study be conducted on the broad range effects of control surface angles on the dynamic stability of the SSP.

7. Above 9.8 knots, the automatic control system is marginally superior to the fixed-control surfaces operating mode (needs 1 percent less shaft rpm and 3 percent less shaft torque and shaft power to reach the desired speed). Below this speed, the fixed-control surfaces condition appears to be more desirable.

8. As expected, rough water operations require more power (on the average of 1 percent more shaft rpm, shaft torque, and shaft power) to reach a desired speed than does calm water operations. No meaningful power savings figures can be extrapolated from the data due to the lack of significant contrast between our nominal rough and calm water conditions. It is recommended that an additional series of trials be undertaken in rough water (State Seas 3 to 5) to further investigate the effectiveness of the automatic control system versus the fixed control surfaces mode of operation.

9. A further extensive investigation into the contouring mode and the platform mode of operation of the automatic control system is recommended. From the data, it appears that the contouring (wave profile) mode is favorably comparable to its automatic control system counterpart.

ACKNOWLEDGMENTS

The authors would like to thank Mssrs. Charles W. Tate, Kenneth E. Newton, and Richard J. Stenson for their invaluable assistance in editing, compilation of data, and technical assistance. Without their help, this

report would not have been possible. We would also like to thank Mrs. Patricia A. Woolaver for her efforts spent in editing and typing this report.

APPENDIX

STATIC AND OPERATIONAL DRAFT MEASUREMENTS

In order to obtain an estimate of the operational draft, a video tape recorder television system was utilized. Cameras mounted on the well deck catwalk were trained on both starboard struts. From the video tapes of each run, it was possible to devise a set of criteria for measuring ship operational draft. Draft mark measurements were taken at the leading edge of each starboard strut during periods of minimal swell and turbulence. From an average of several measurements taken during the duration of each three-minute run, an average forward and aft draft was determined. A video tape example of the measurement modus operandi is presented in Figure 38. Table 19 is a tabulation of the draft measurements obtained.

A comparison of average operational trim calculated from the video tapes and that obtained using DTNSRDC roll and pitch gyros, is presented in Table 19 for the calm water runs. Both trims compare well for a majority of the runs. Discrepancies occur due to the difficulty in reading the video tape draft markings. For this reason, rough water comparison runs are not presented though they were recorded. Camera lens condensation, camera positioning difficulties, and spray were a few of the problems encountered. It is suggested that a sonic waveheight probe, in conjunction with the video system, be utilized for future draft mark determination.

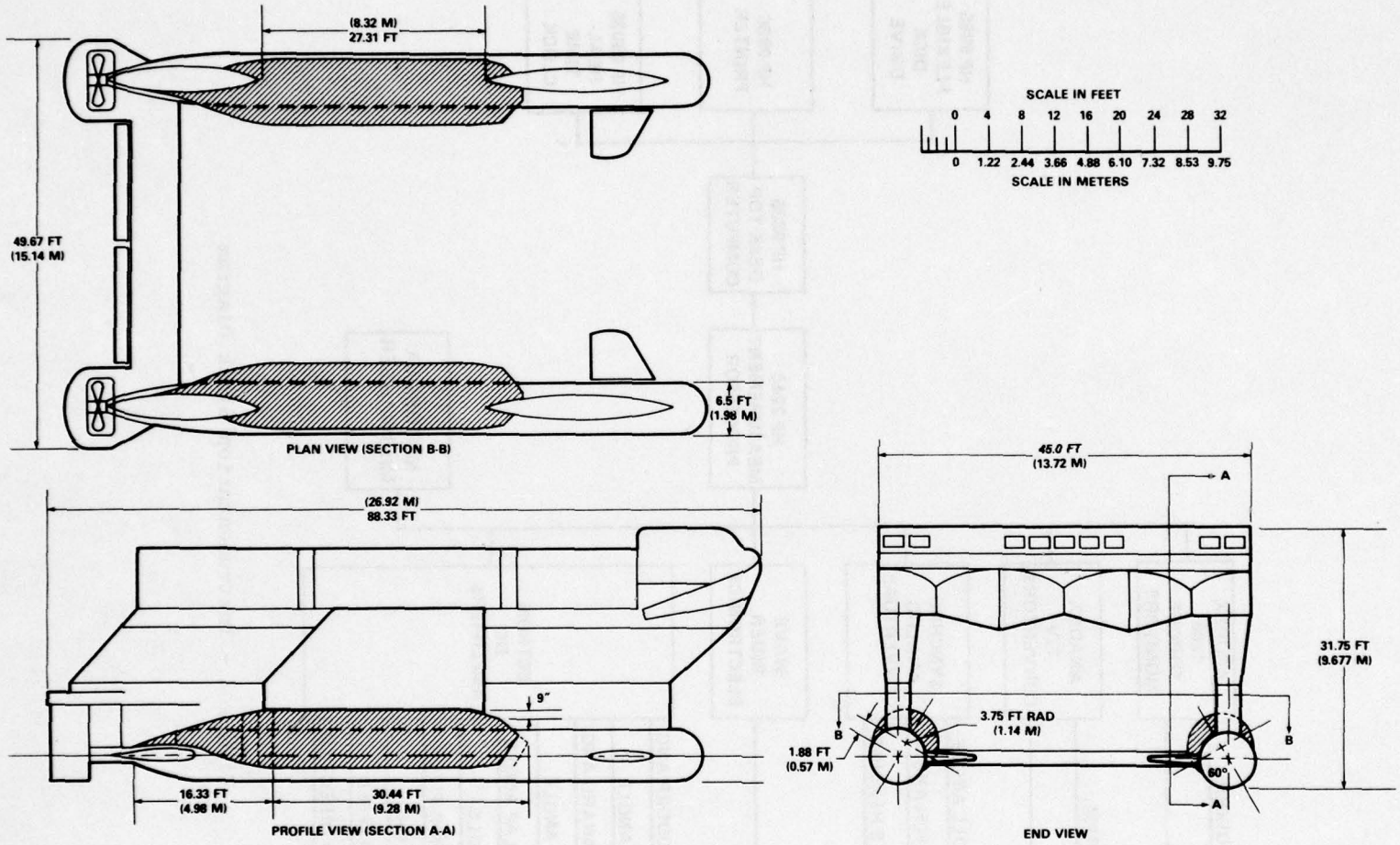

Figure 1 - SSP KAIMALINO, Dimensions of the New Buoyancy Module Configuration

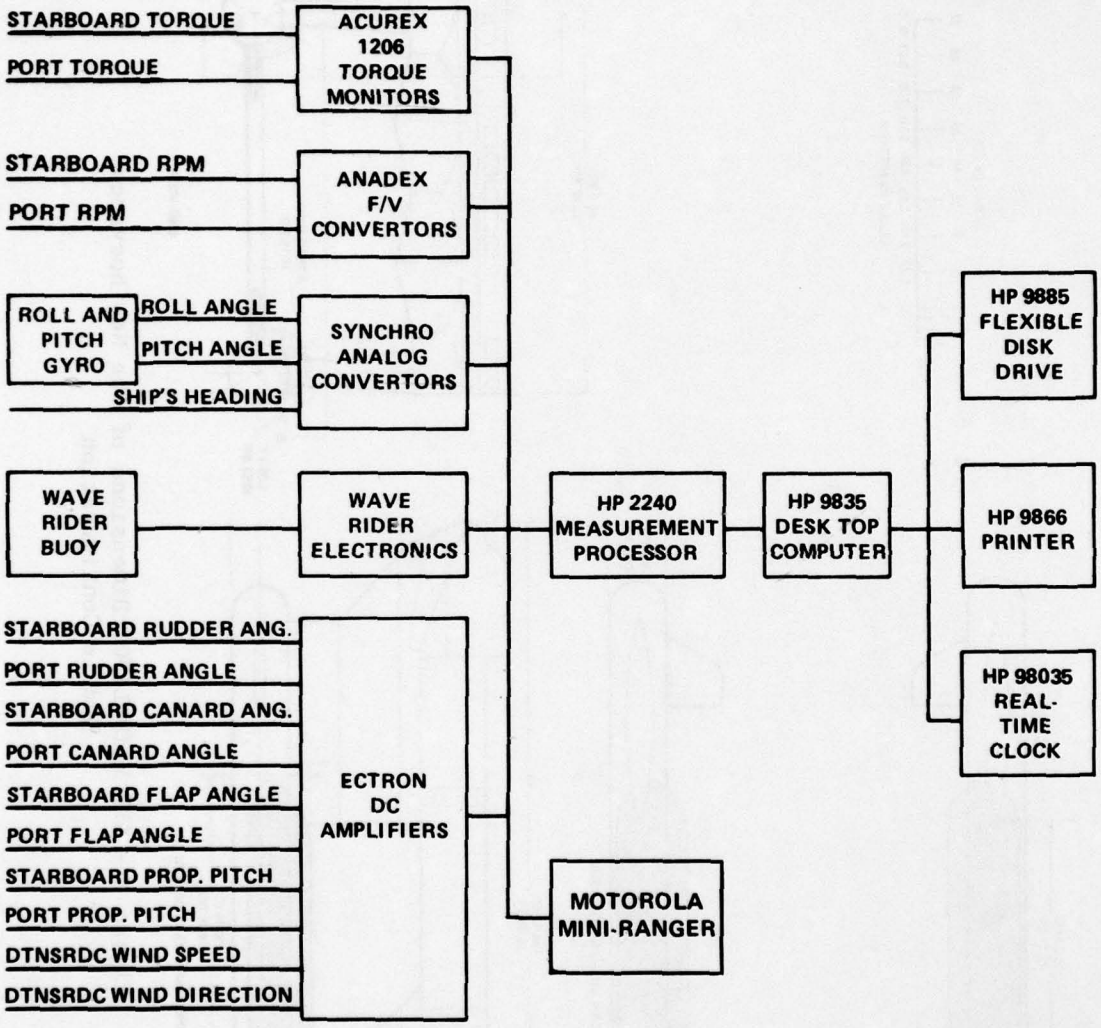

Figure 2 - Instrumentation Block Diagram

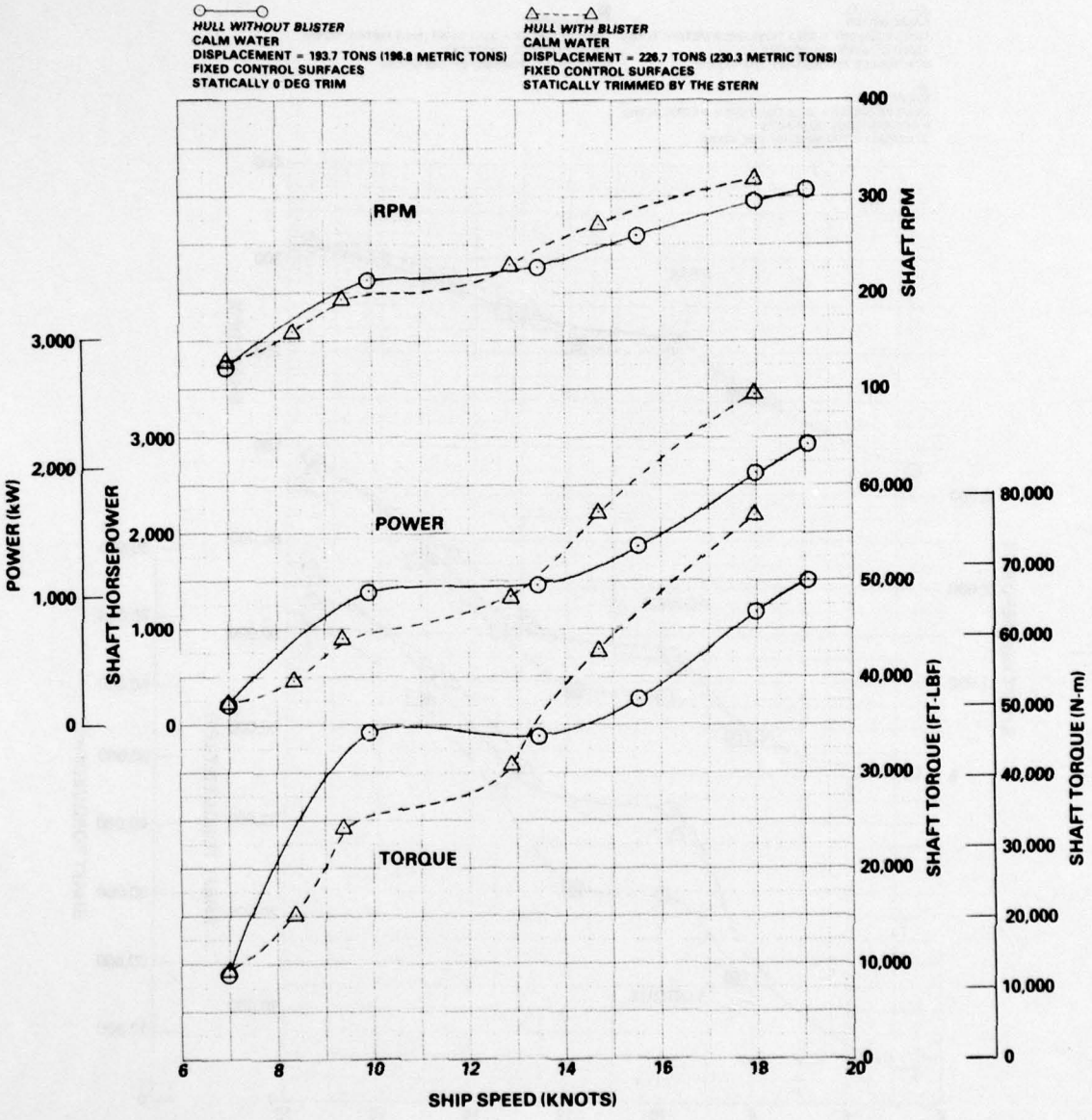

Figure 3 - Comparison of SSP KAIMALINO Standardization Trial Results for the Non-Blister and Blister Module Hull Configurations

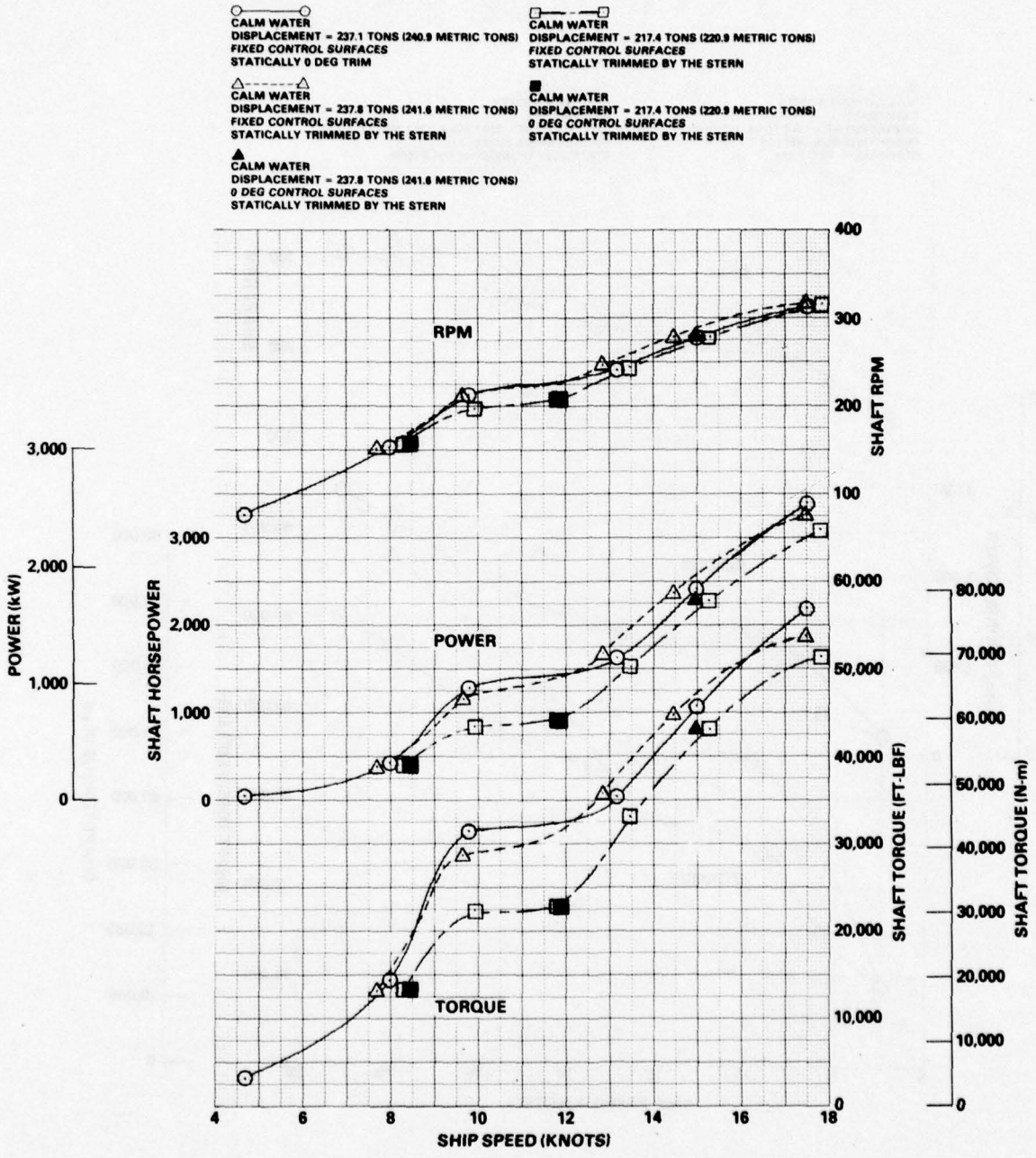

Figure 4 - Comparison of Statically Trimmed by the Stern Heavy and Light Displacement Standardization Trial Results versus Heavy Displacement Statically 0 Degree Trim Standardization Trial Results

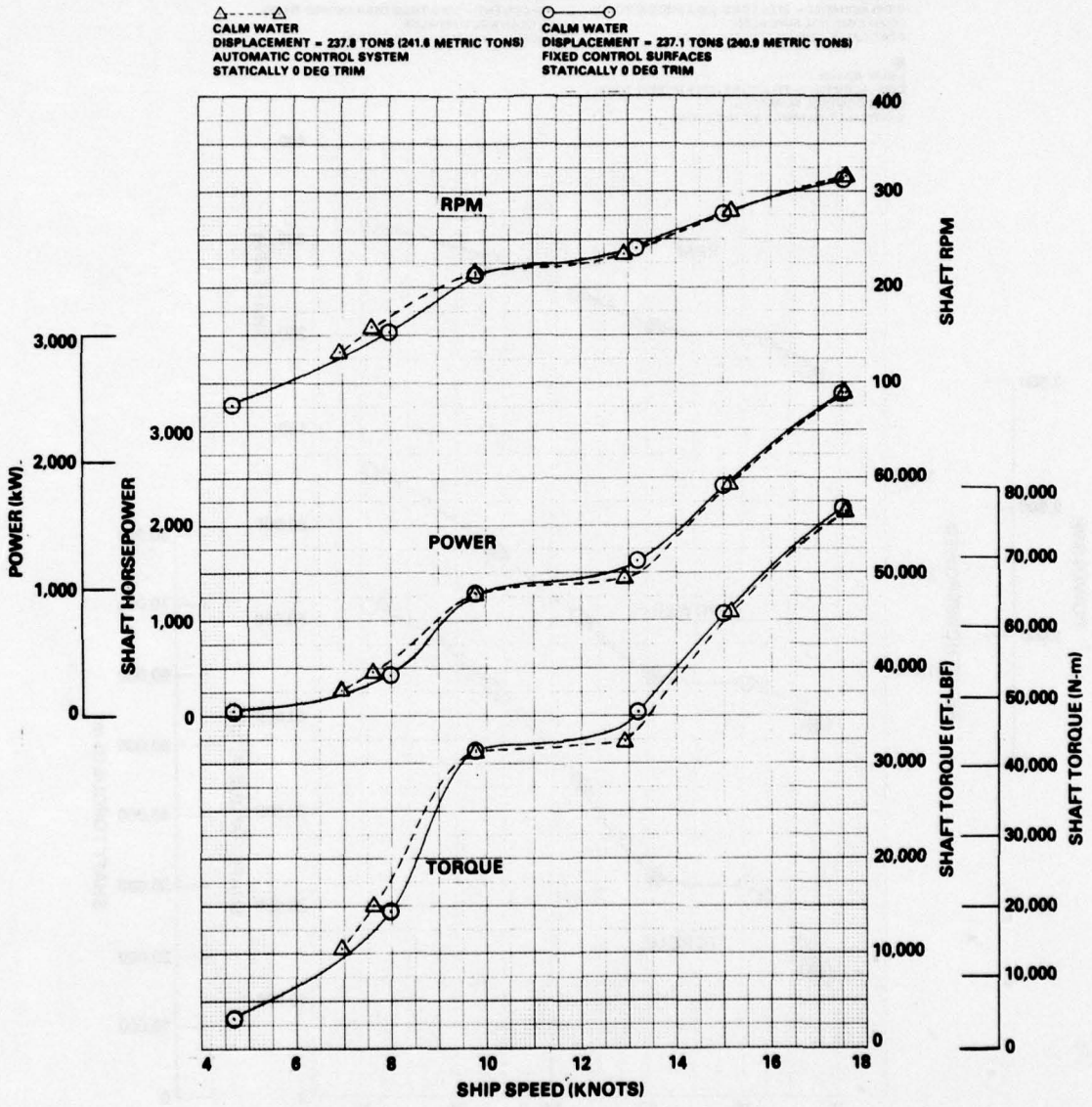

Figure 5 - Comparison of Automatic Control System versus Fixed Control Surfaces Standardization Trial Results

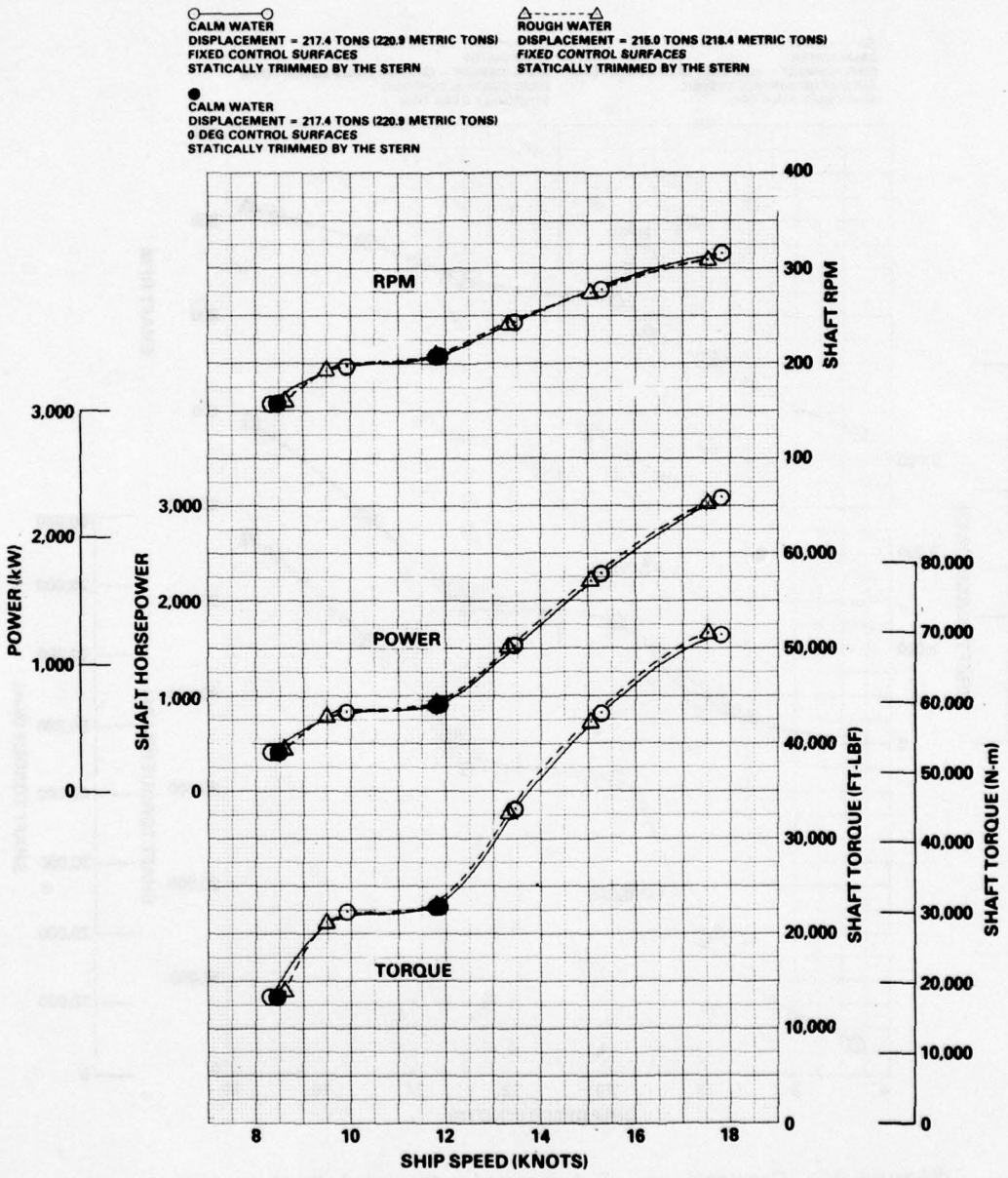

Figure 6 - Comparison of Rough and Calm Water Standardization Trial Results

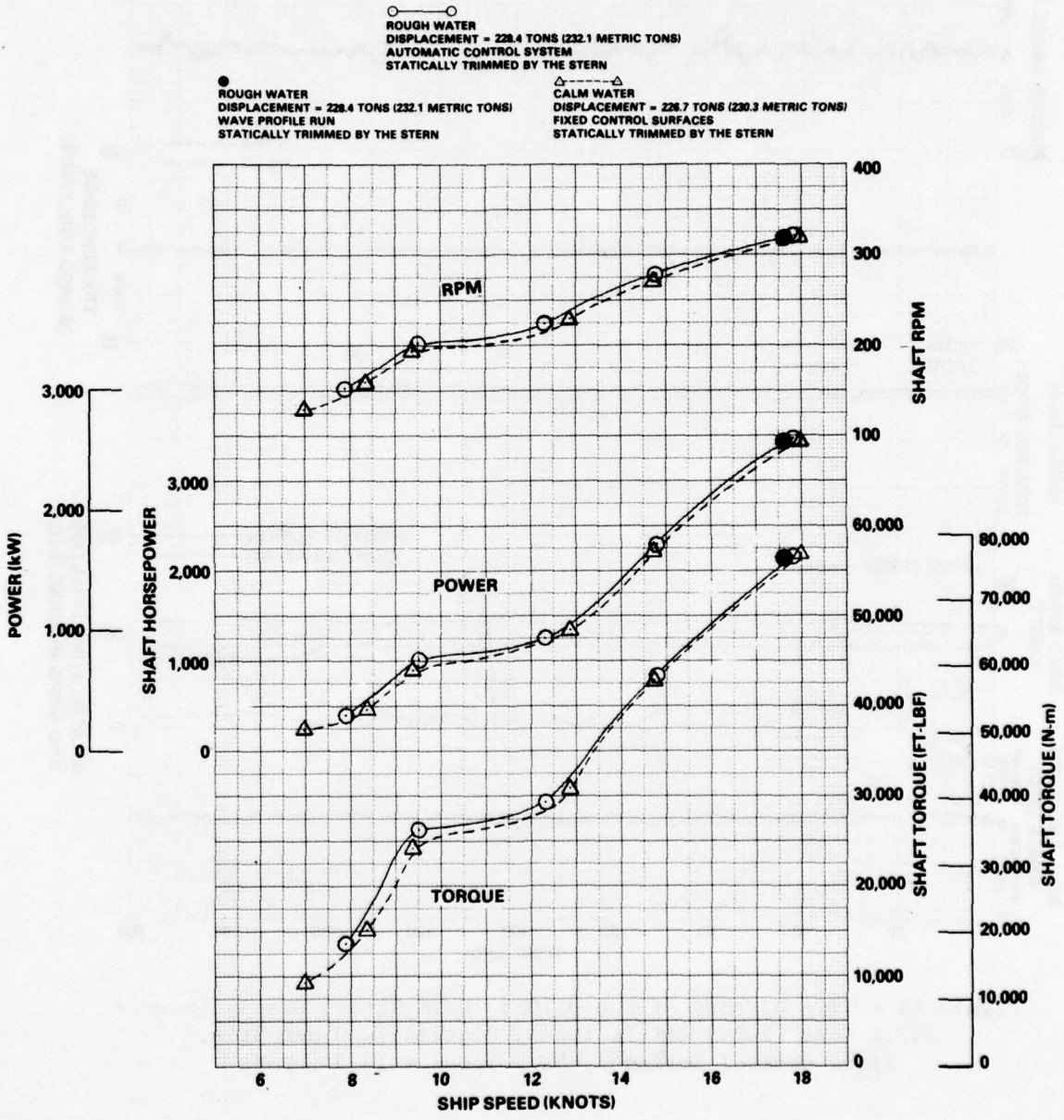

Figure 7 - Medium Displacement Standardization Trial Results

Figure 8 - Time History of Run 0110S

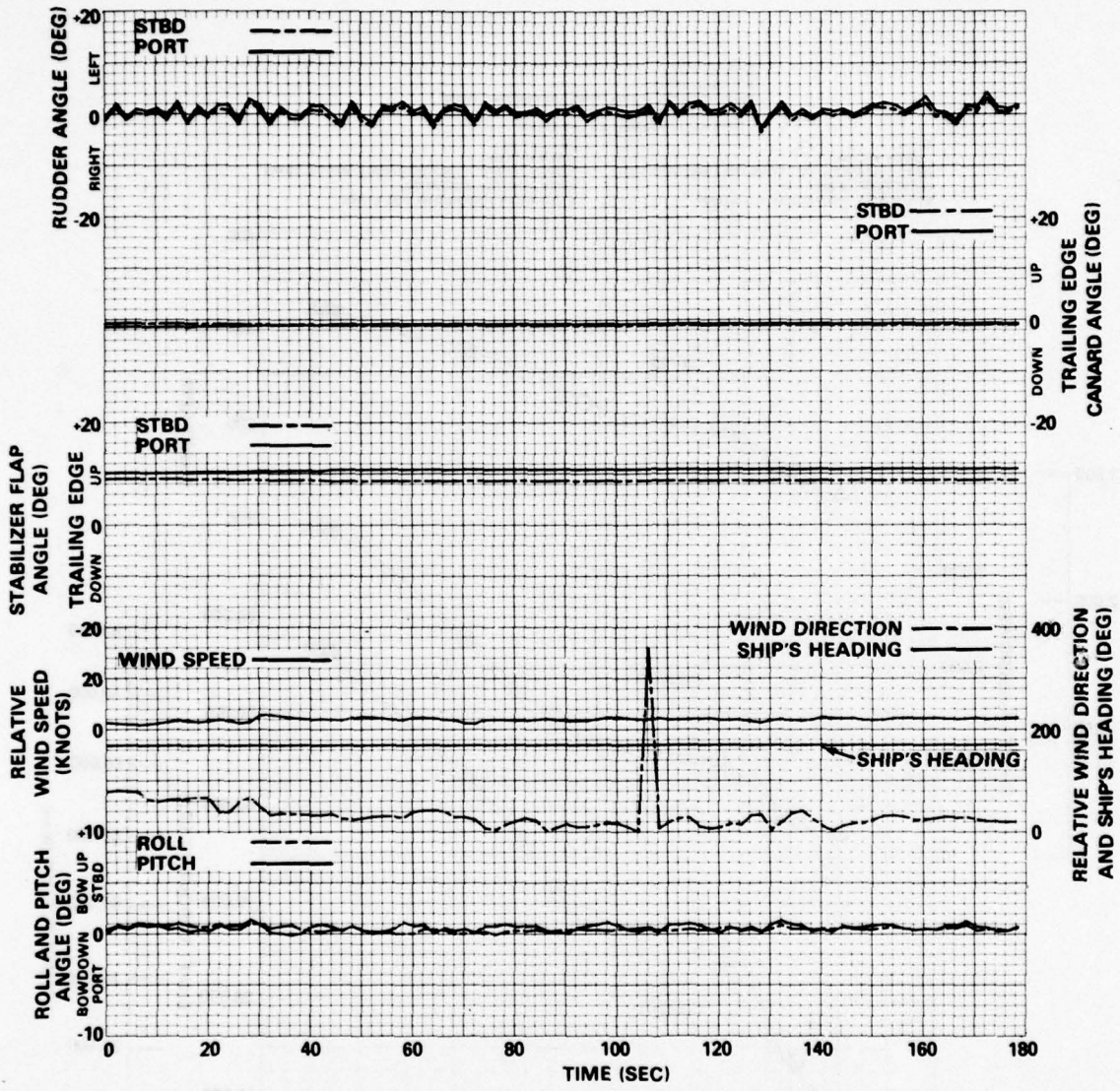

Figure 8a - Time History of Run 0110S: Calm Water, Displacement = 237.1 tons (240.9 metric tons), Statically 0 deg Trim, Fixed Control Surfaces, Ship Speed = 13.34 knots

Figure 8 (Continued)

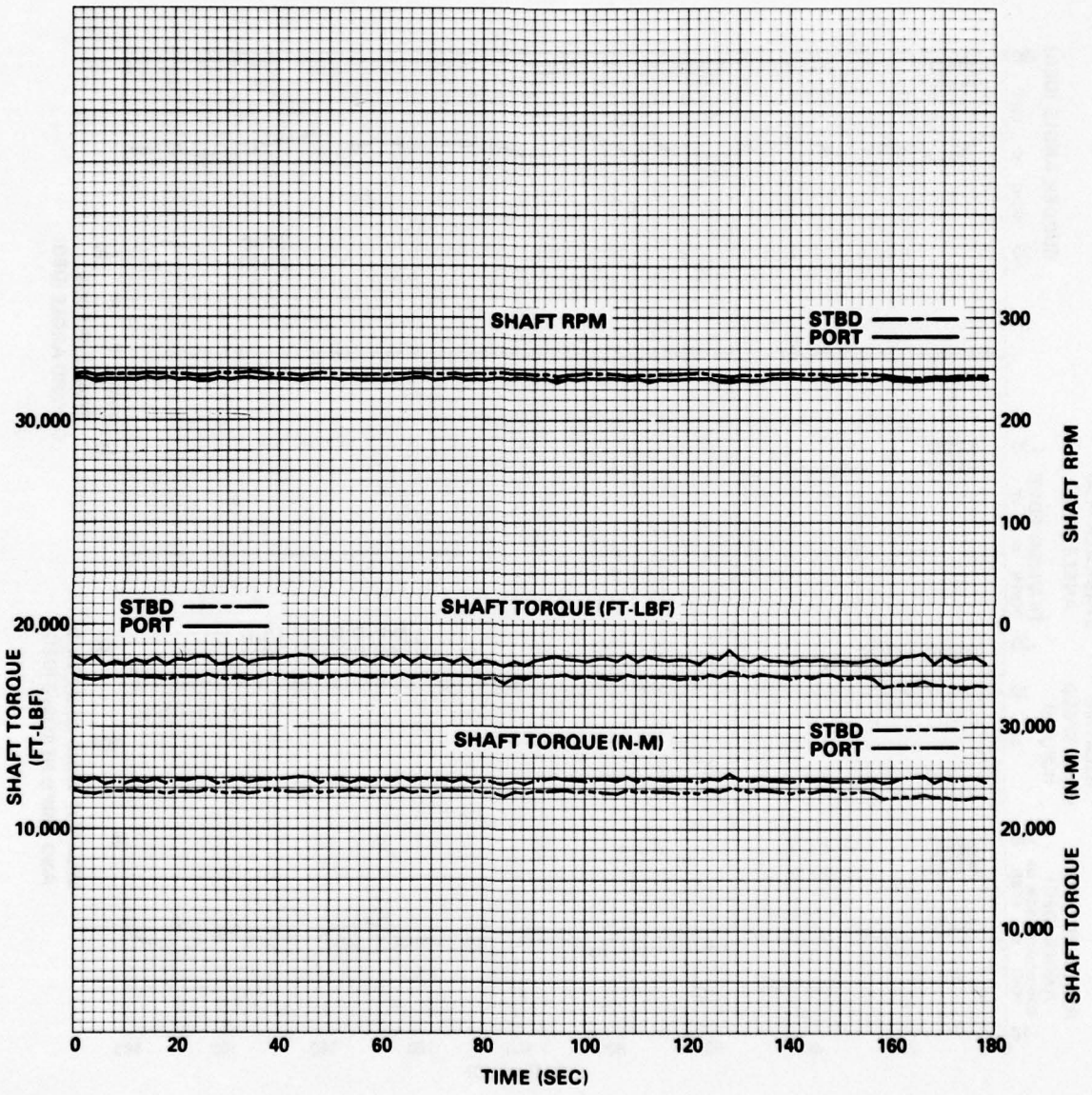

Figure 8b - Time History of Run 0110S: Calm Water, Displacement = 237.1 tons (240.9 metric tons), Statically 0 deg Trim, Fixed Control Surfaces, Ship Speed = 13.34 knots

Figure 9 - Time History of Run 0190N

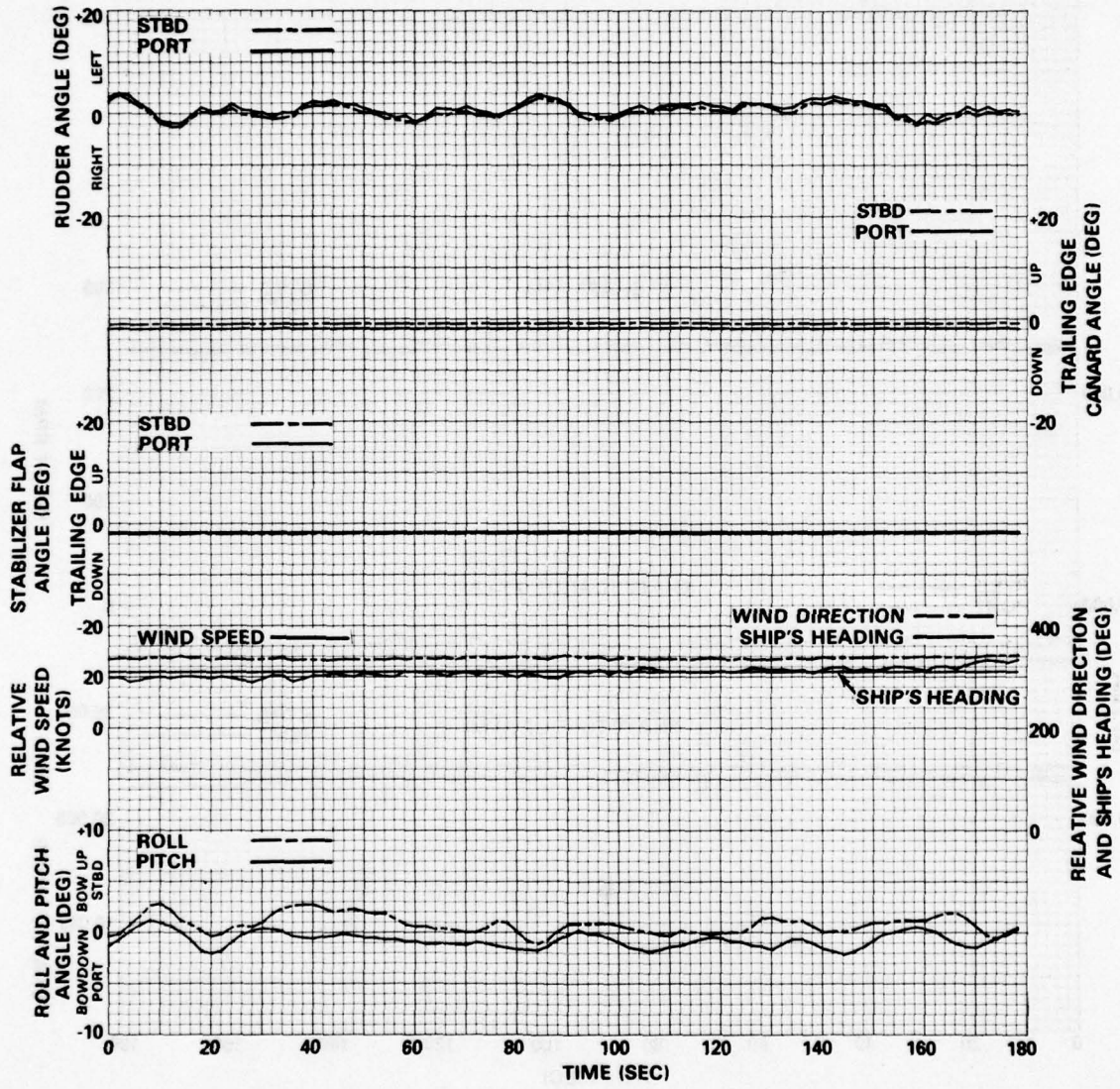

Figure 9a - Time History of Run 0190N: Calm Water, Displacement = 237.1 tons (240.9 metric tons), Statically 0 deg Trim, Fixed Control Surfaces, Ship Speed = 17.44 knots

Figure 9 (Continued)

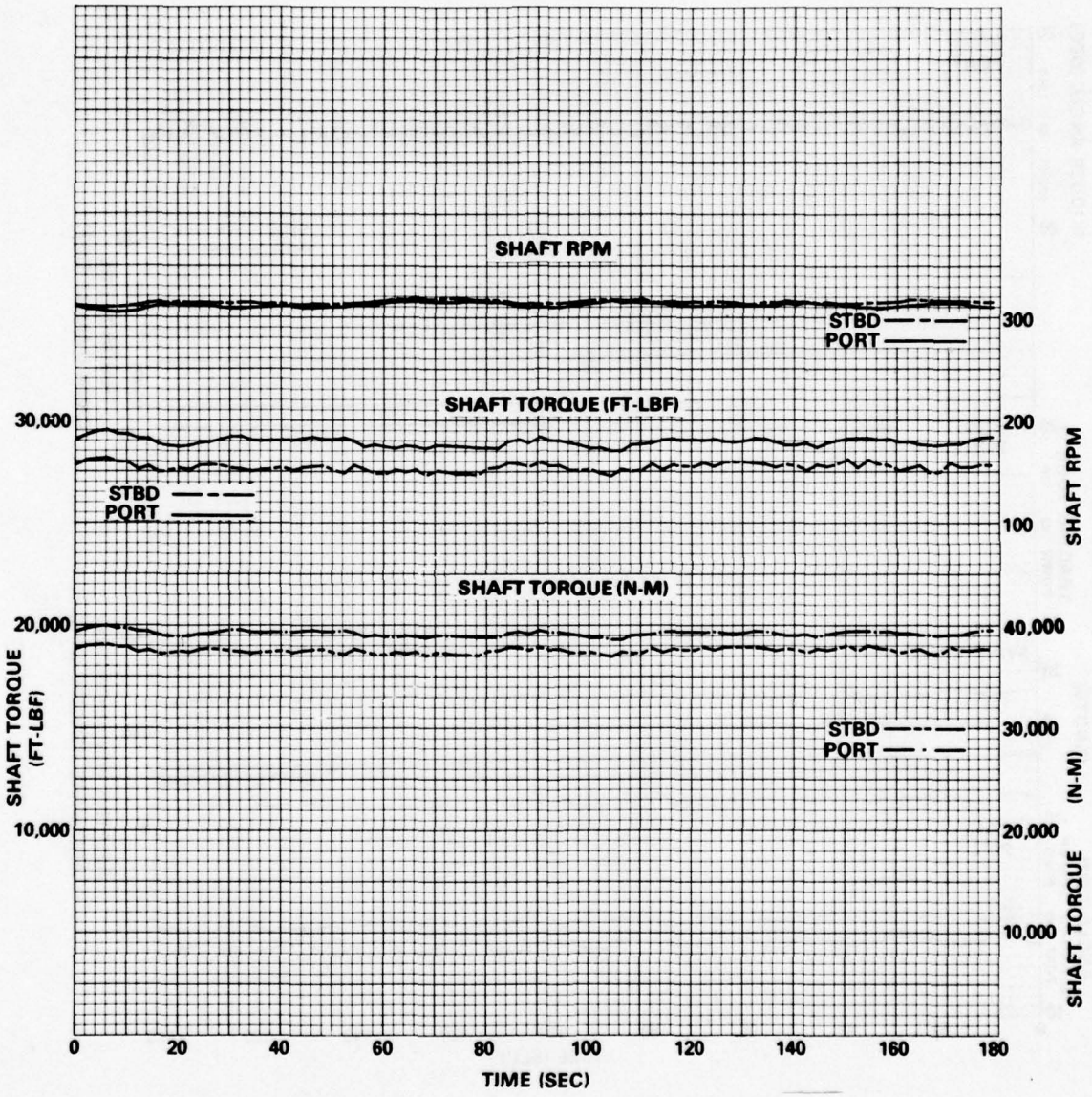

Figure 9b - Time History of Run 0190N: Calm Water, Displacement = 237.1 tons (240.9 metric tons), Statically 0 deg Trim, Fixed Control Surfaces, Ship Speed = 17.44 knots

Figure 10 - Time History of Run 0280S

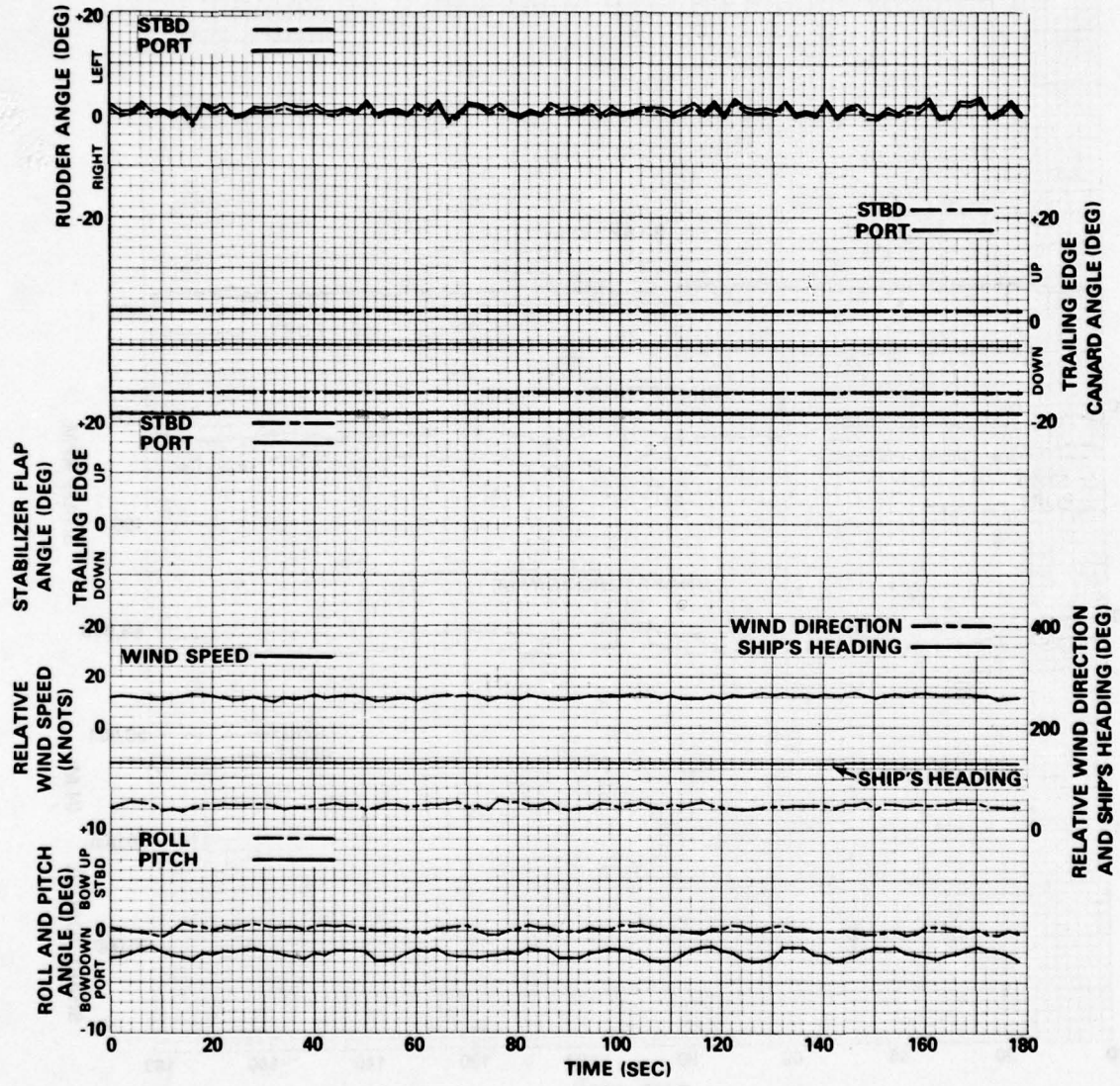

Figure 10a - Time History of Run 0280S: Calm Water, Displacement = 237.8 tons (241.6 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 13.02 knots

Figure 10 (Continued)

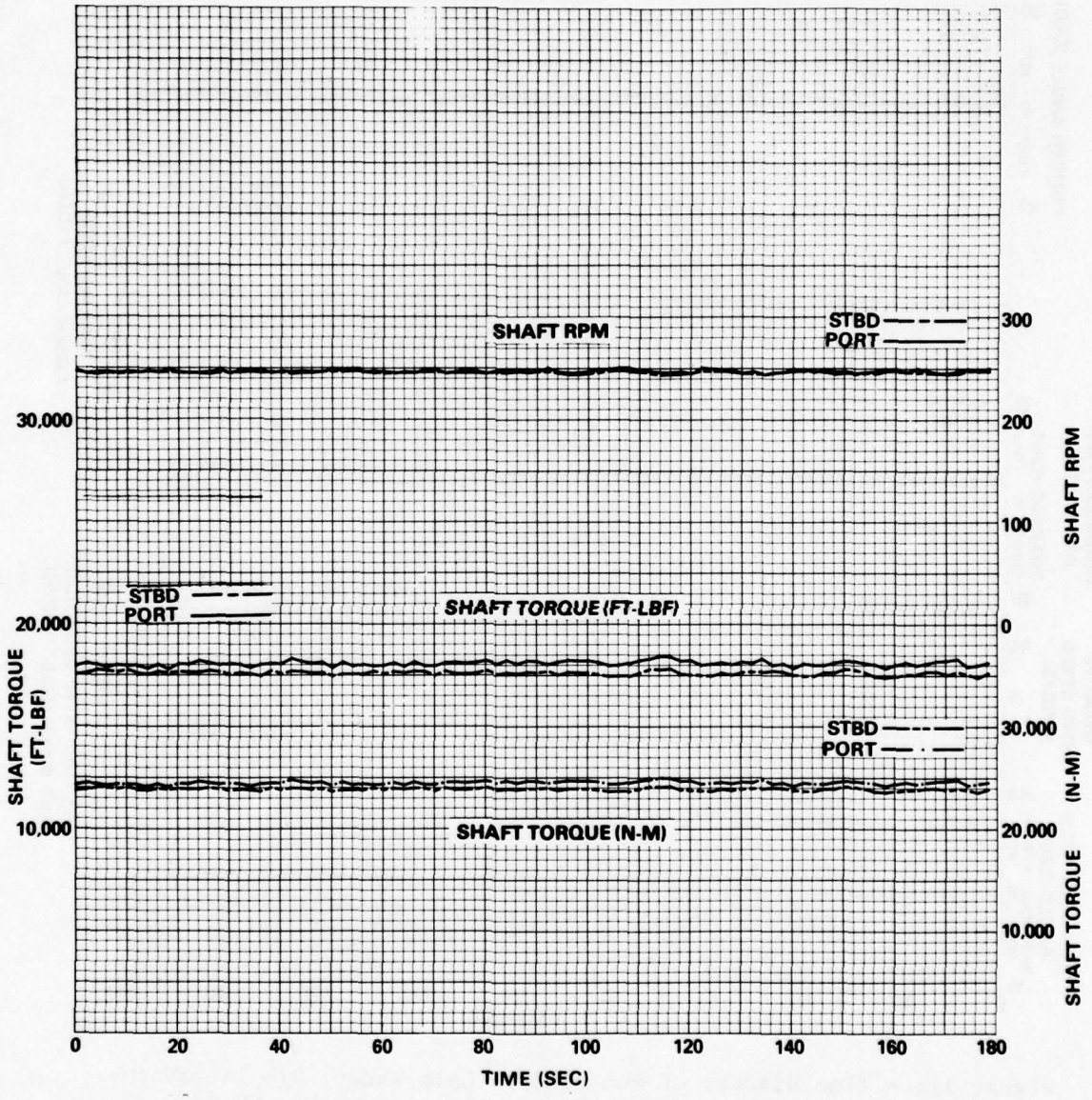

Figure 10b - Time History of Run 0280S: Calm Water, Displacement = 237.8 tons (241.6 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 13.02 knots

Figure 11 - Time History of Run 0320S

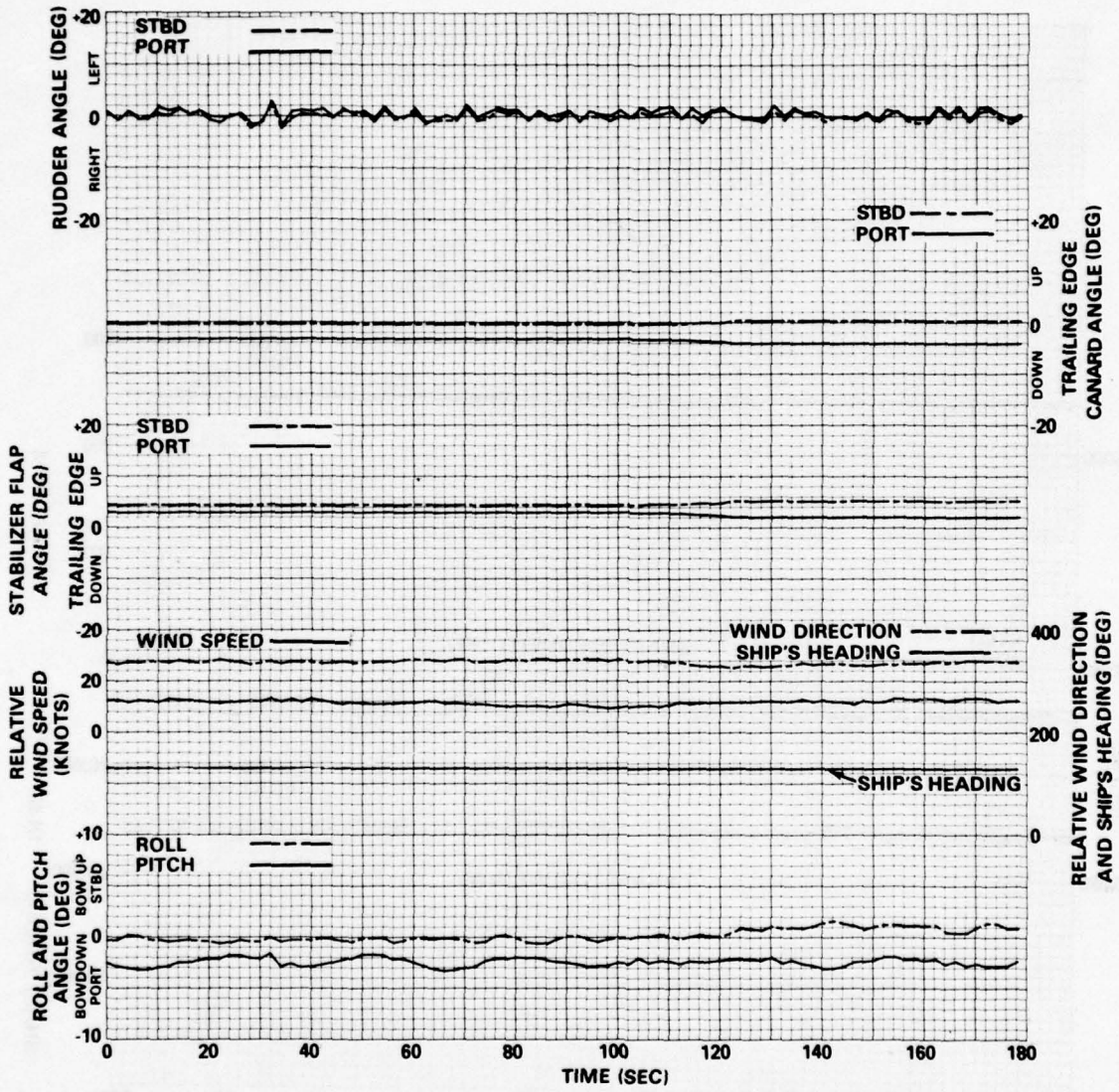

Figure 11a - Time History of Run 0320S: Calm Water, Displacement = 237.8 tons (241.6 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 17.67 knots

Figure 11 (Continued)

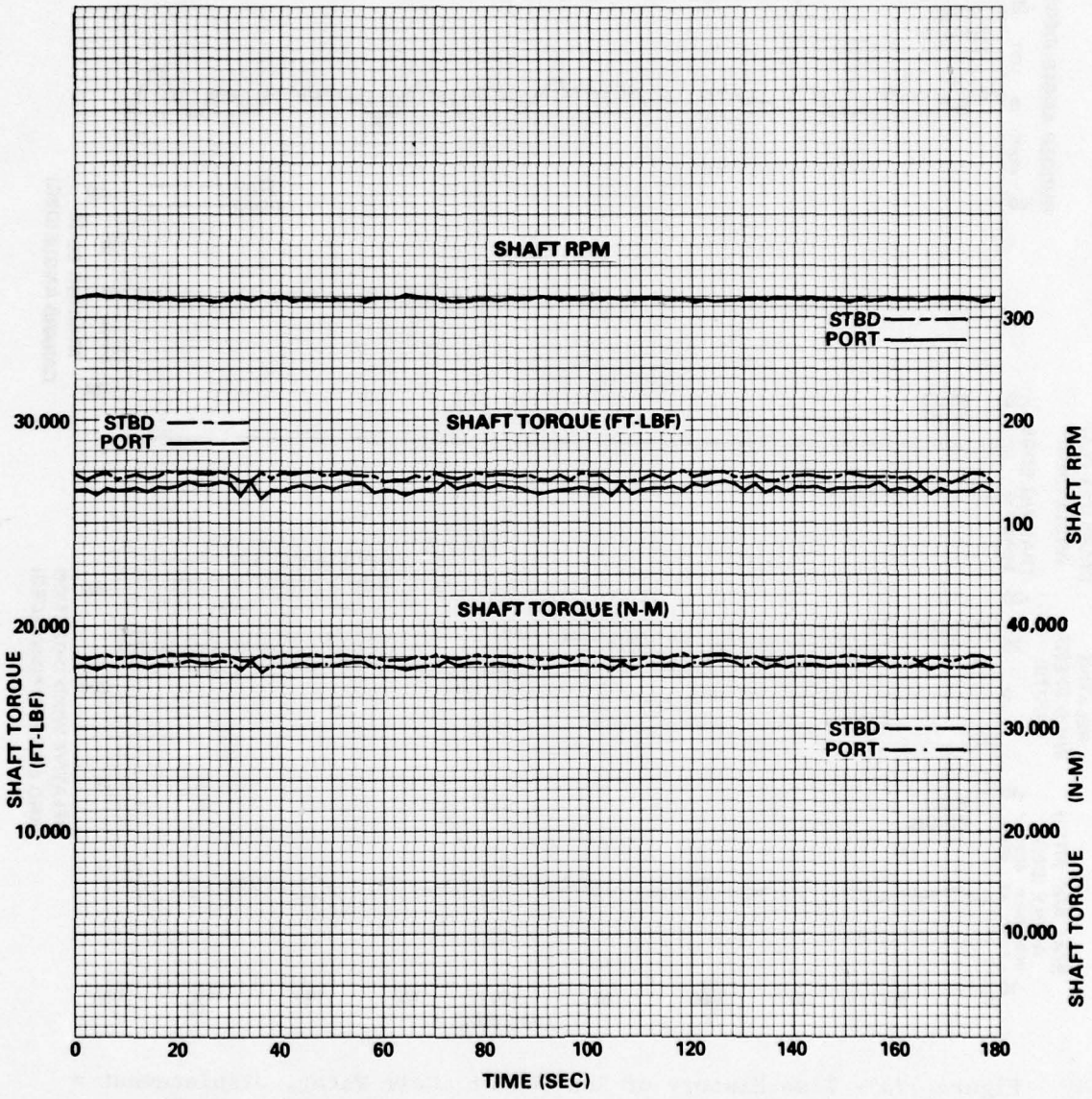

Figure 11b - Time History of Run 0320S: Calm Water, Displacement = 237.8 tons (241.6 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 17.67 knots

Figure 12 - Time History of Run 0440N

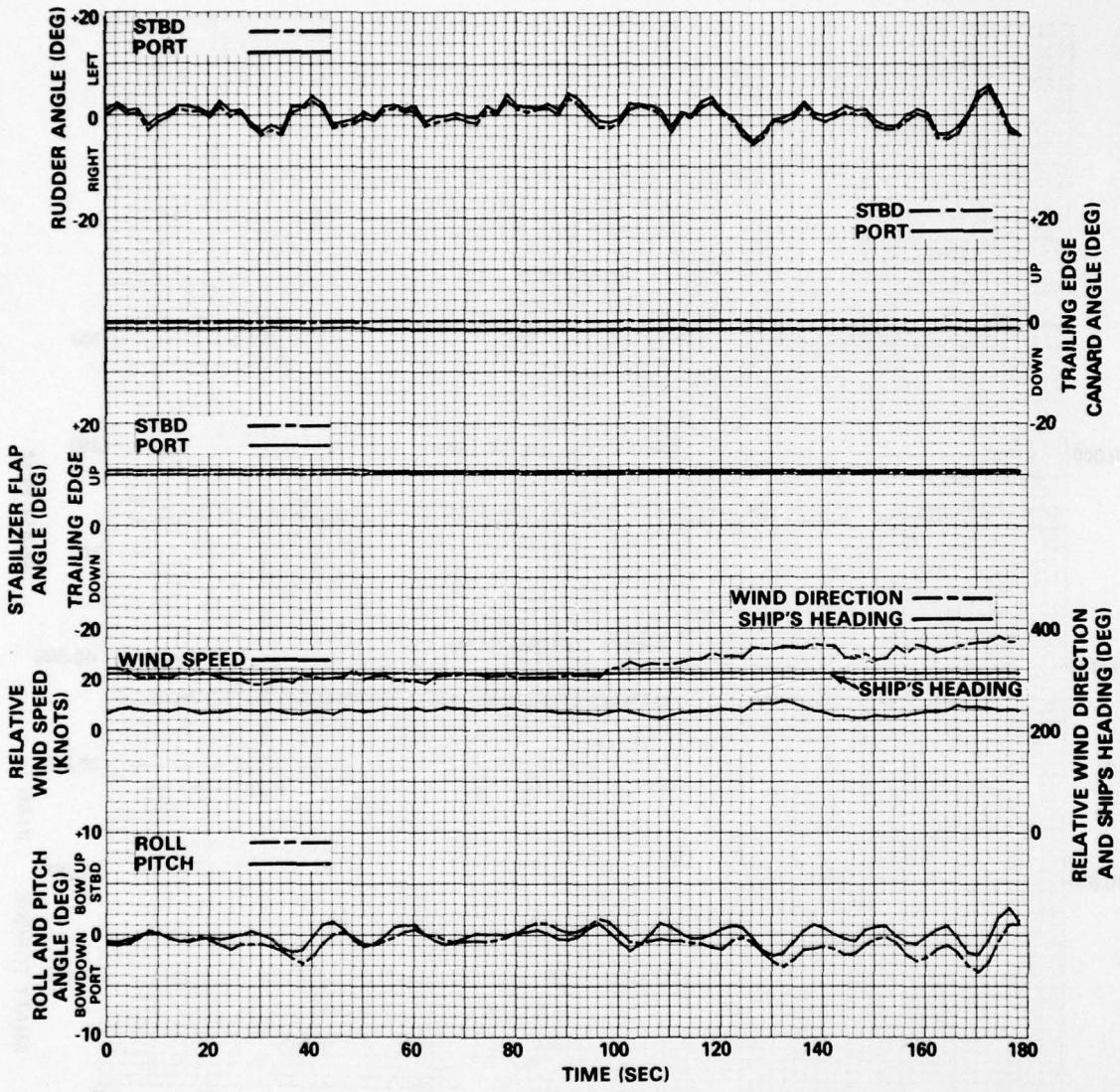

Figure 12a - Time History of Run 0440N: Calm Water, Displacement = 217.4 tons (220.9 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 12.19 knots

Figure 12 (Continued)

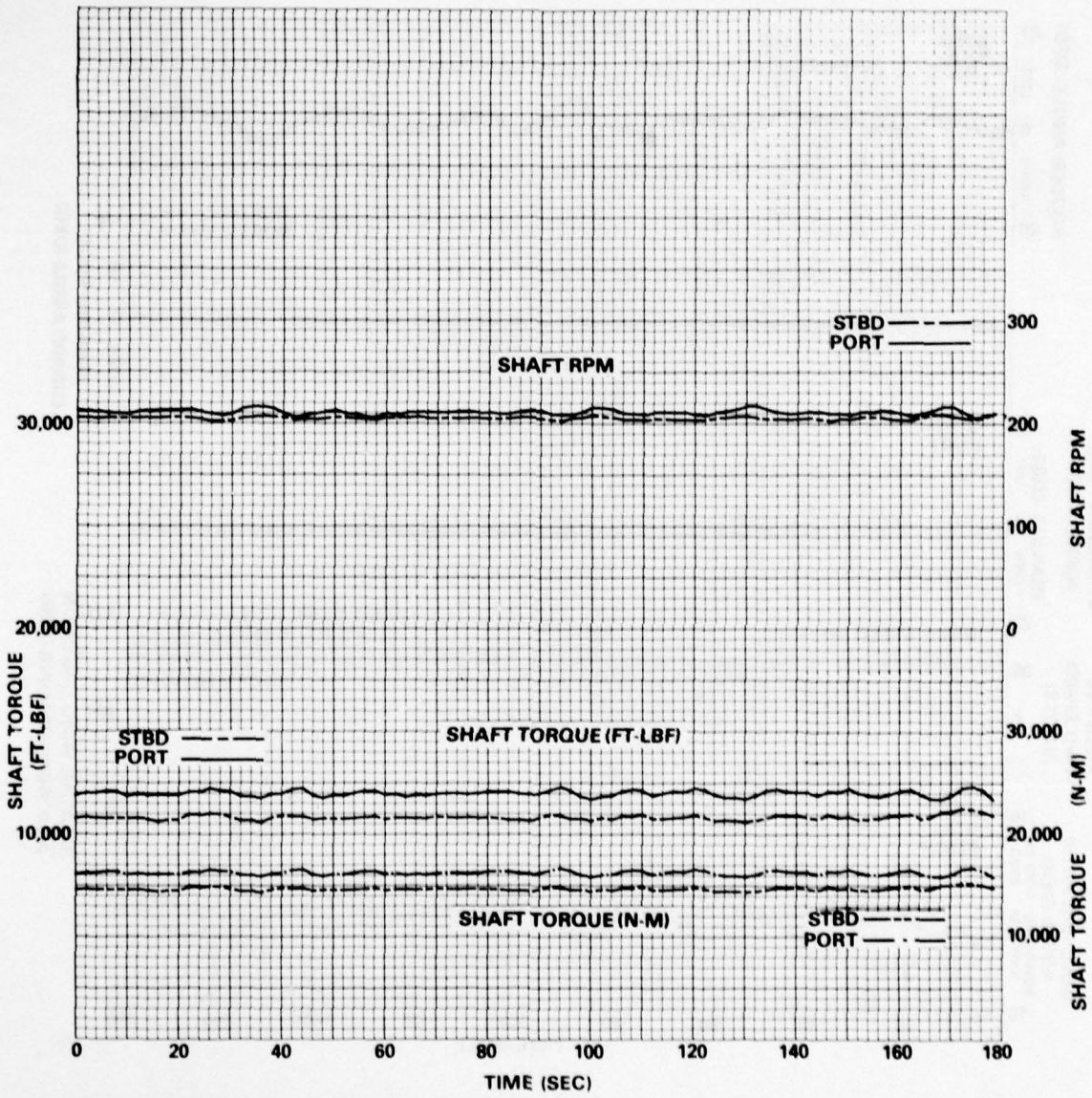

Figure 12b - Time History of Run 0440N: Calm Water, Displacement = 217.4 tons (220.9 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 12.19 knots

Figure 13 - Time History of Run 0540N

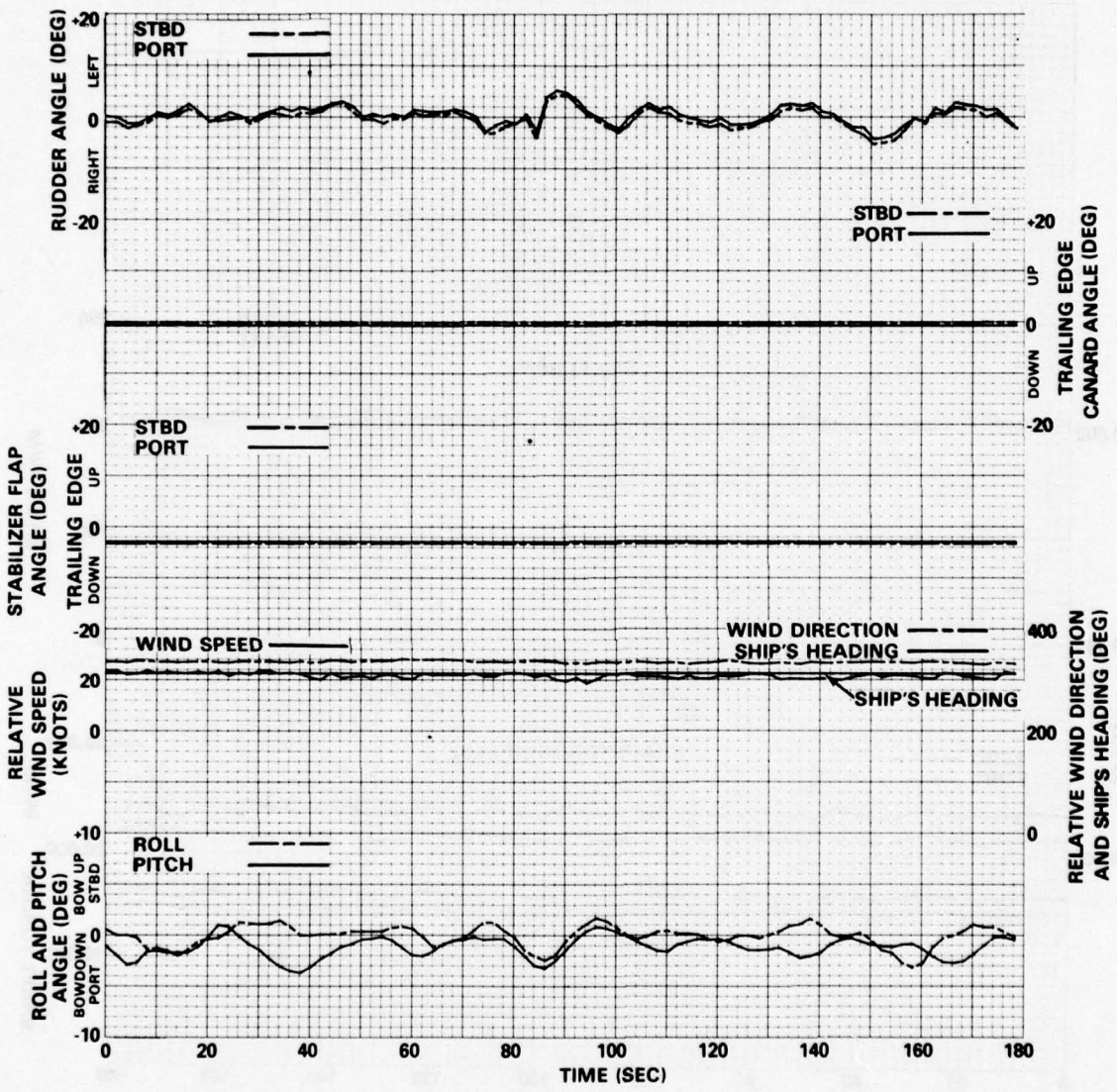

Figure 13a - Time History of Run 0540N: Calm Water, Displacement = 217.4 tons (220.9 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 17.18 knots

Figure 13 (Continued)

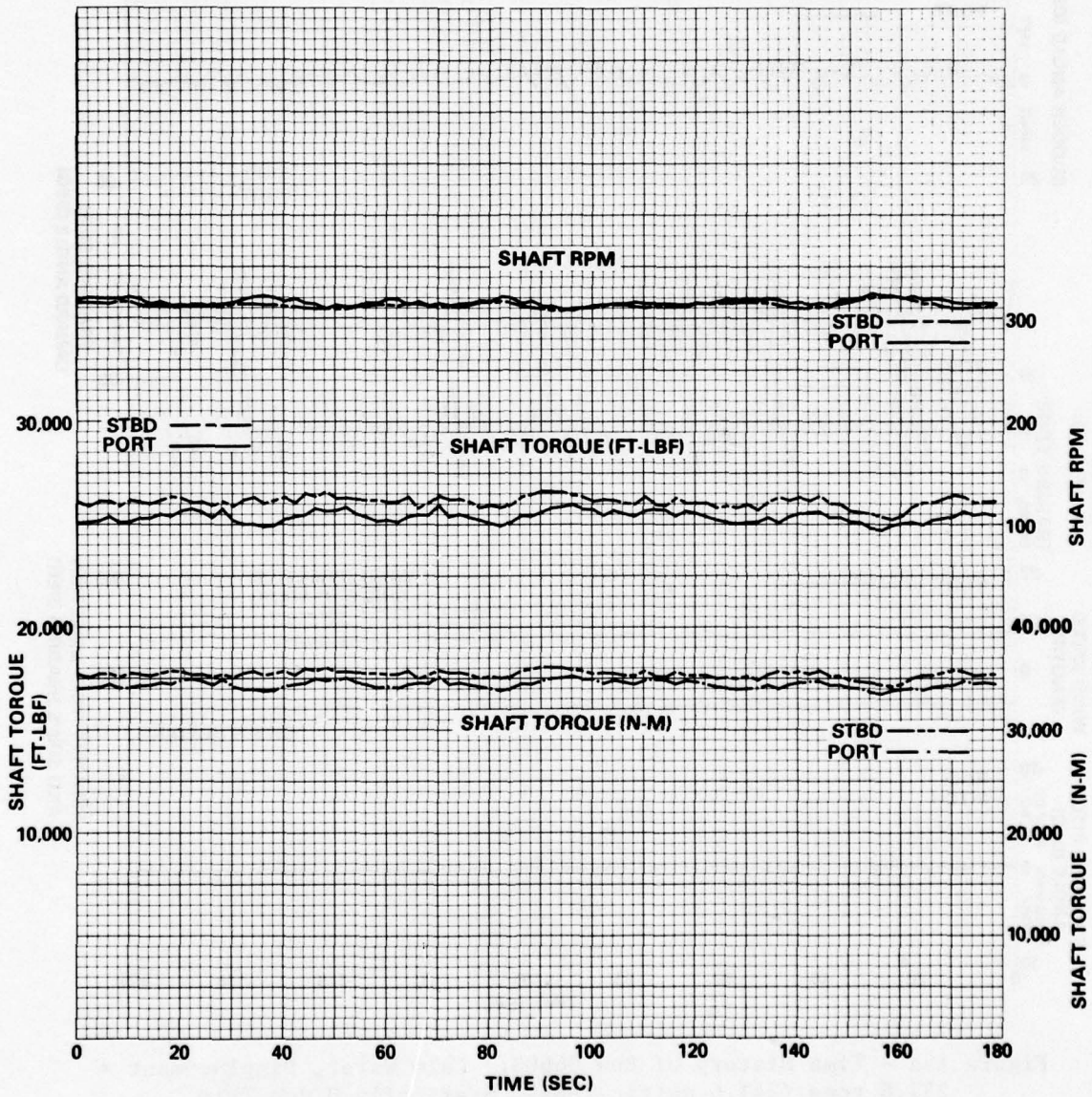

Figure 13b - Time History of Run 0540N: Calm Water, Displacement = 217.4 tons (220.9 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 17.18 knots

Figure 14 - Time History of Run 0660S

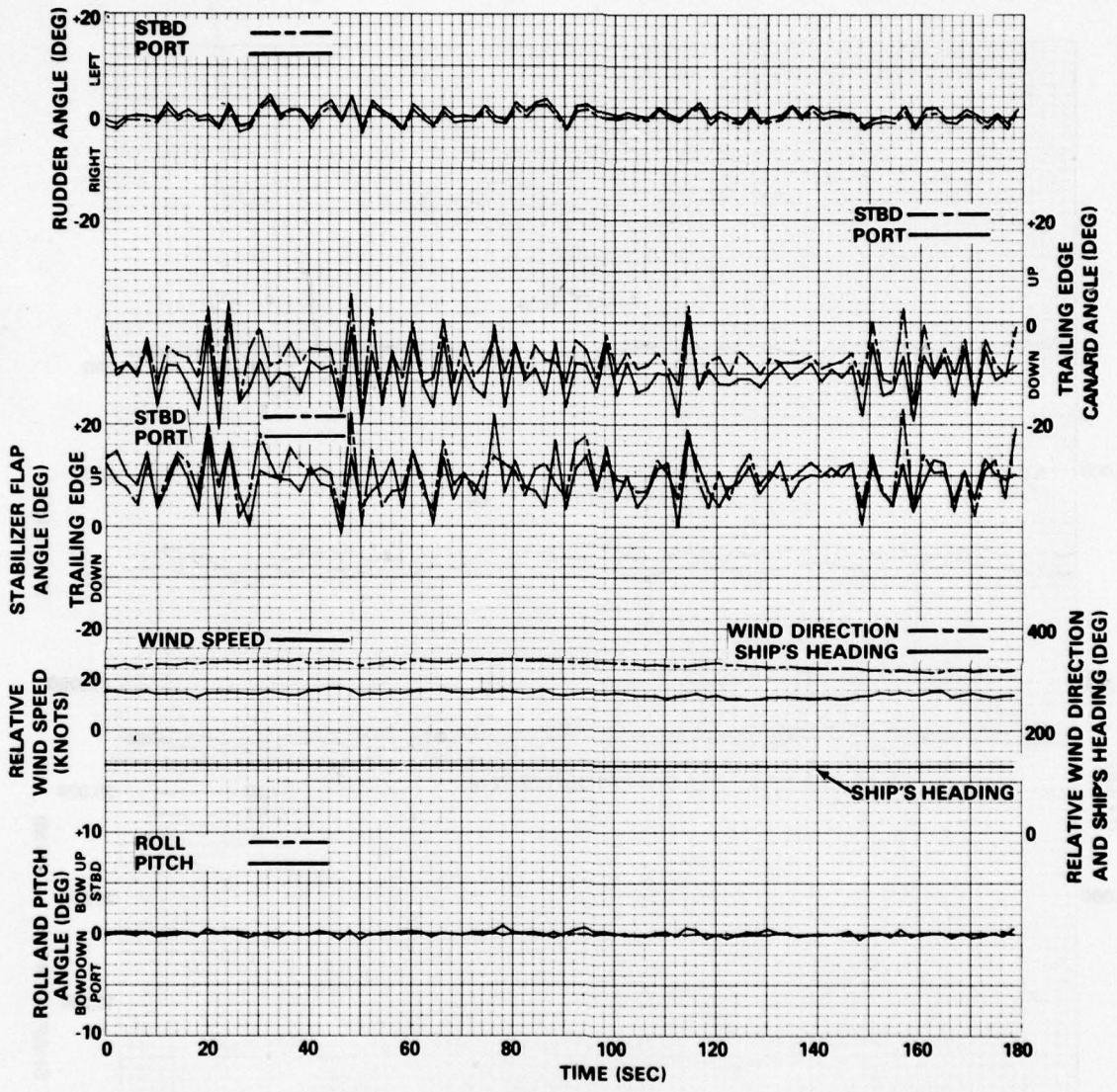

Figure 14a - Time History of Run 0660S: Calm Water, Displacement = 237.8 tons (241.6 metric tons), Statically 0 deg Trim, Automatic Control System, Ship Speed = 13.58 knots

Figure 14 (Continued)

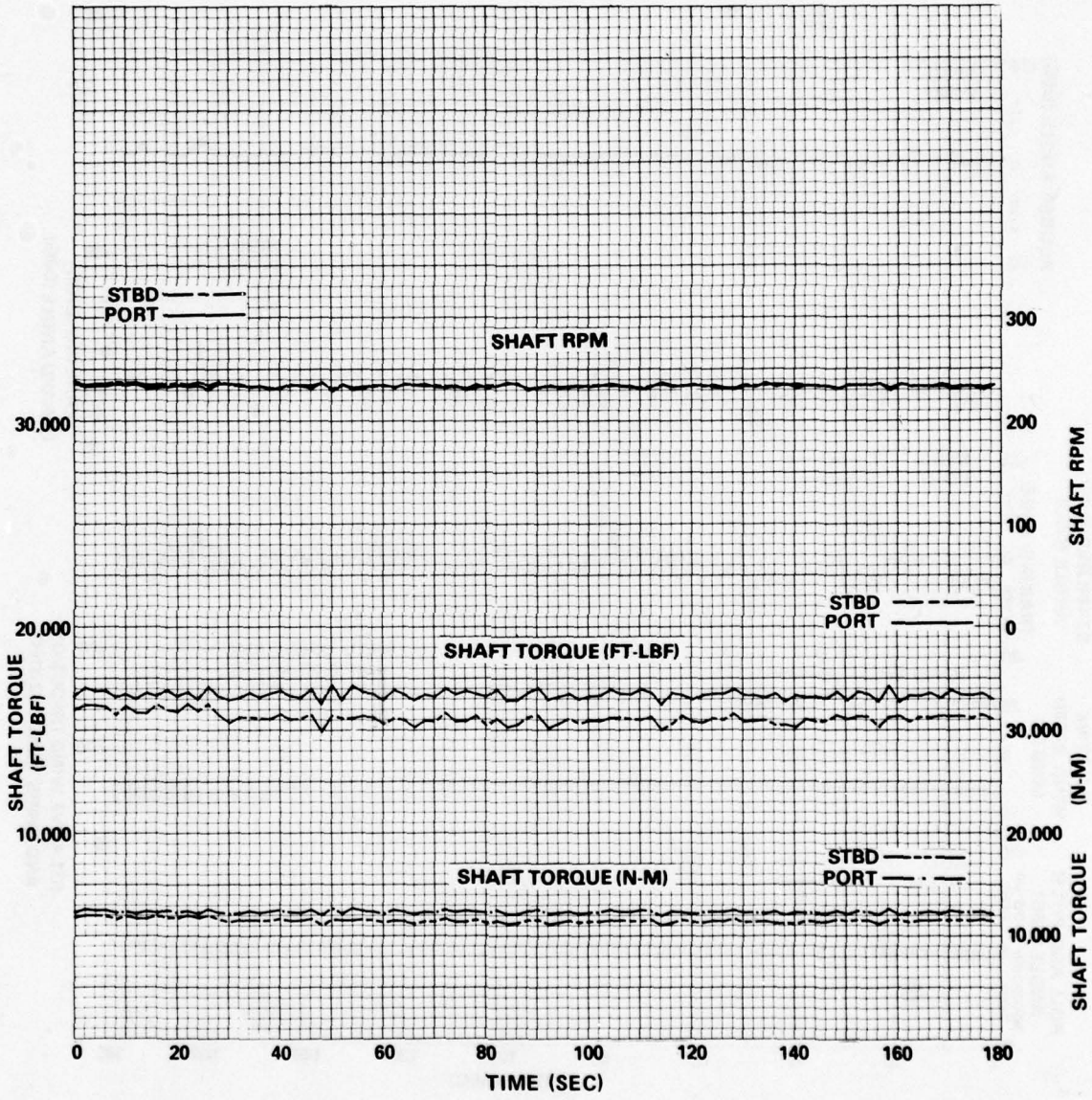

Figure 14b - Time History of Run 0660S: Calm Water, Displacement = 237.8 tons (241.6 metric tons), Statically 0 deg Trim, Automatic Control System, Ship Speed = 13.58 knots

Figure 15 - Time History of Run 0710S

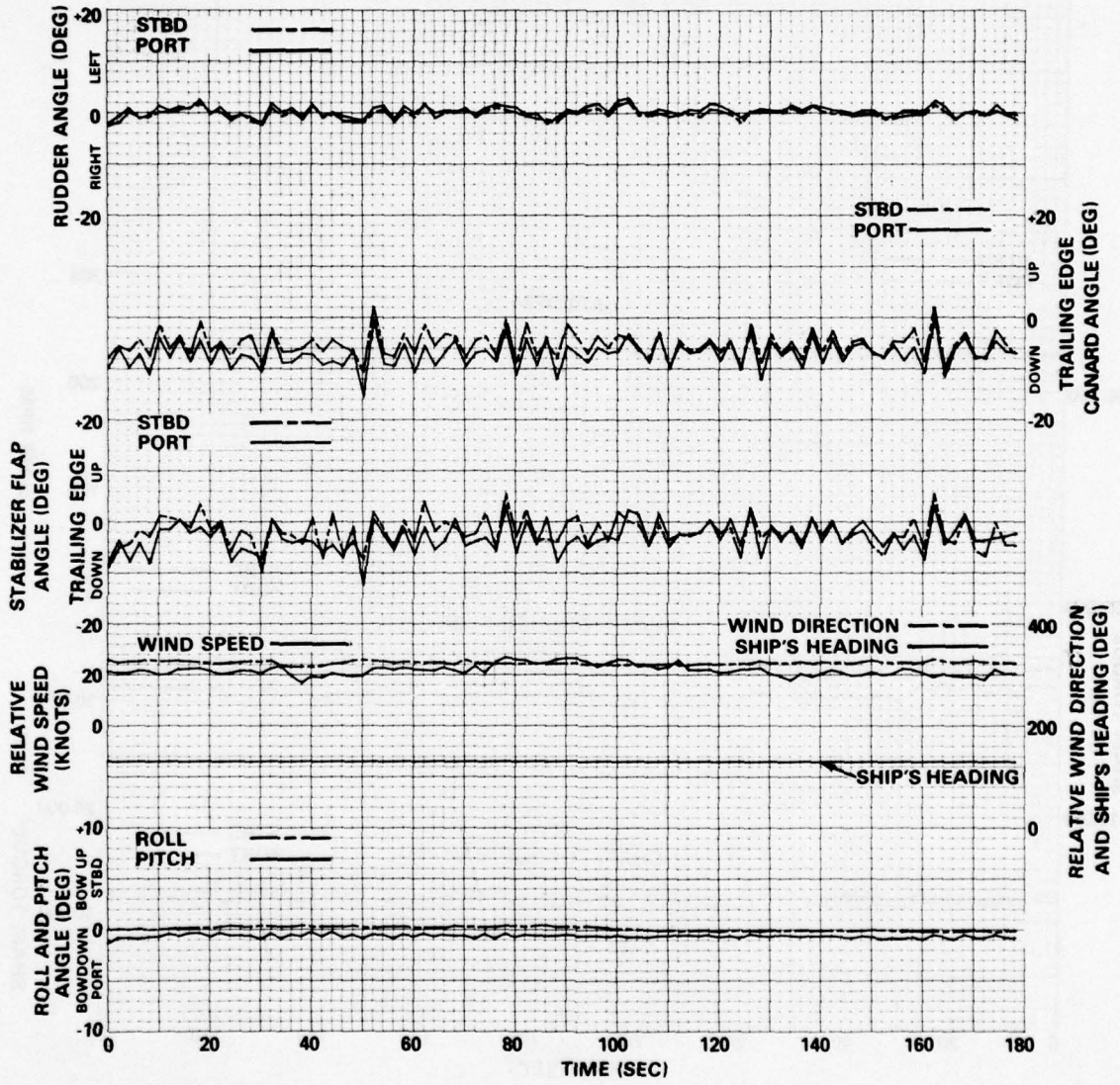

Figure 15a - Time History of Run 0710S: Calm Water, Displacement = 237.8 tons (241.6 metric tons), Statically 0 deg Trim, Automatic Control System, Ship Speed = 17.83 knots

Figure 15 (Continued)

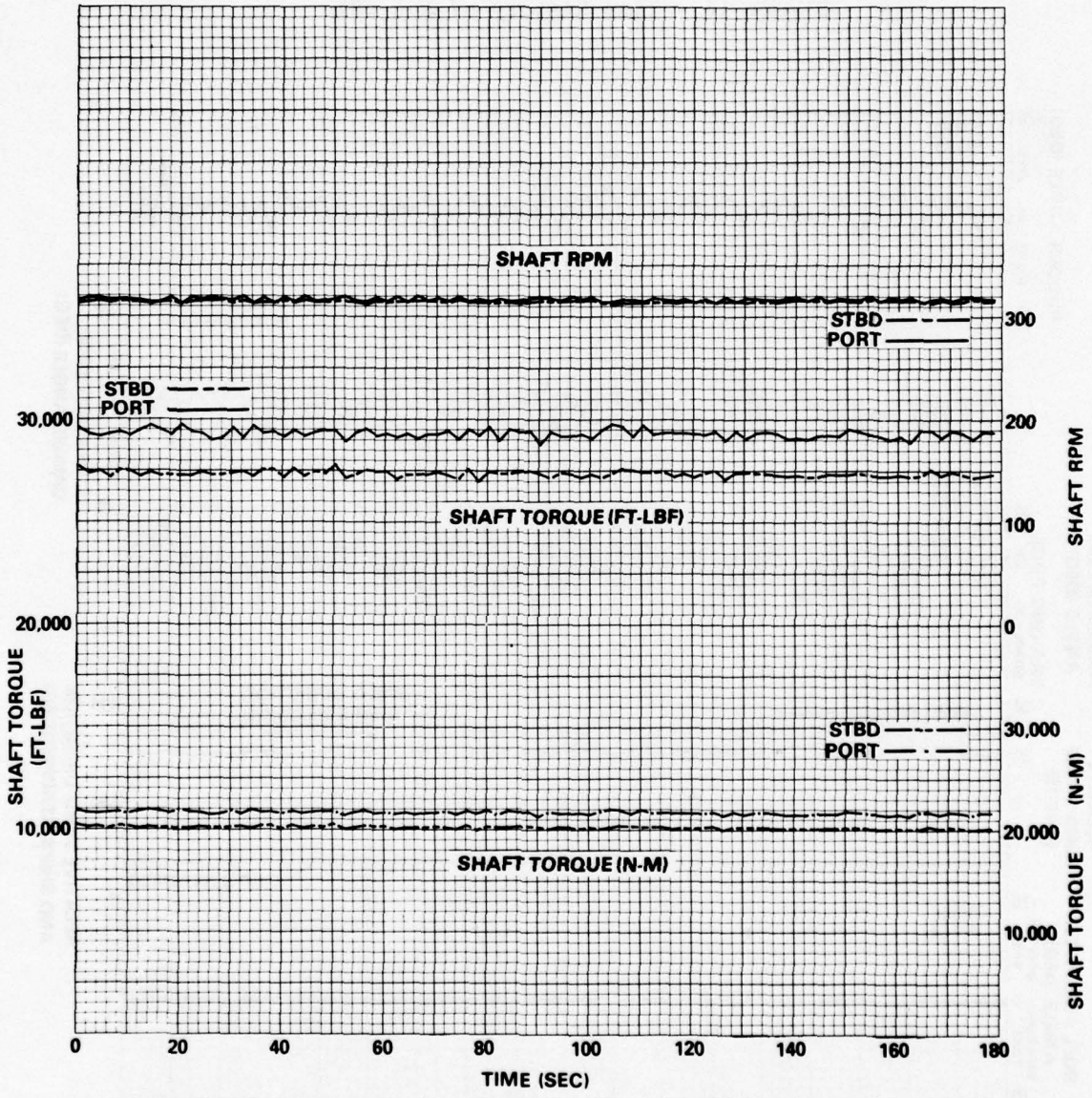

Figure 15b - Time History of Run 0710S: Calm Water, Displacement = 237.8 tons (241.6 metric tons), Statically 0 deg Trim, Automatic Control System, Ship Speed = 17.83 knots

Figure 16 - Time History of Run 0810

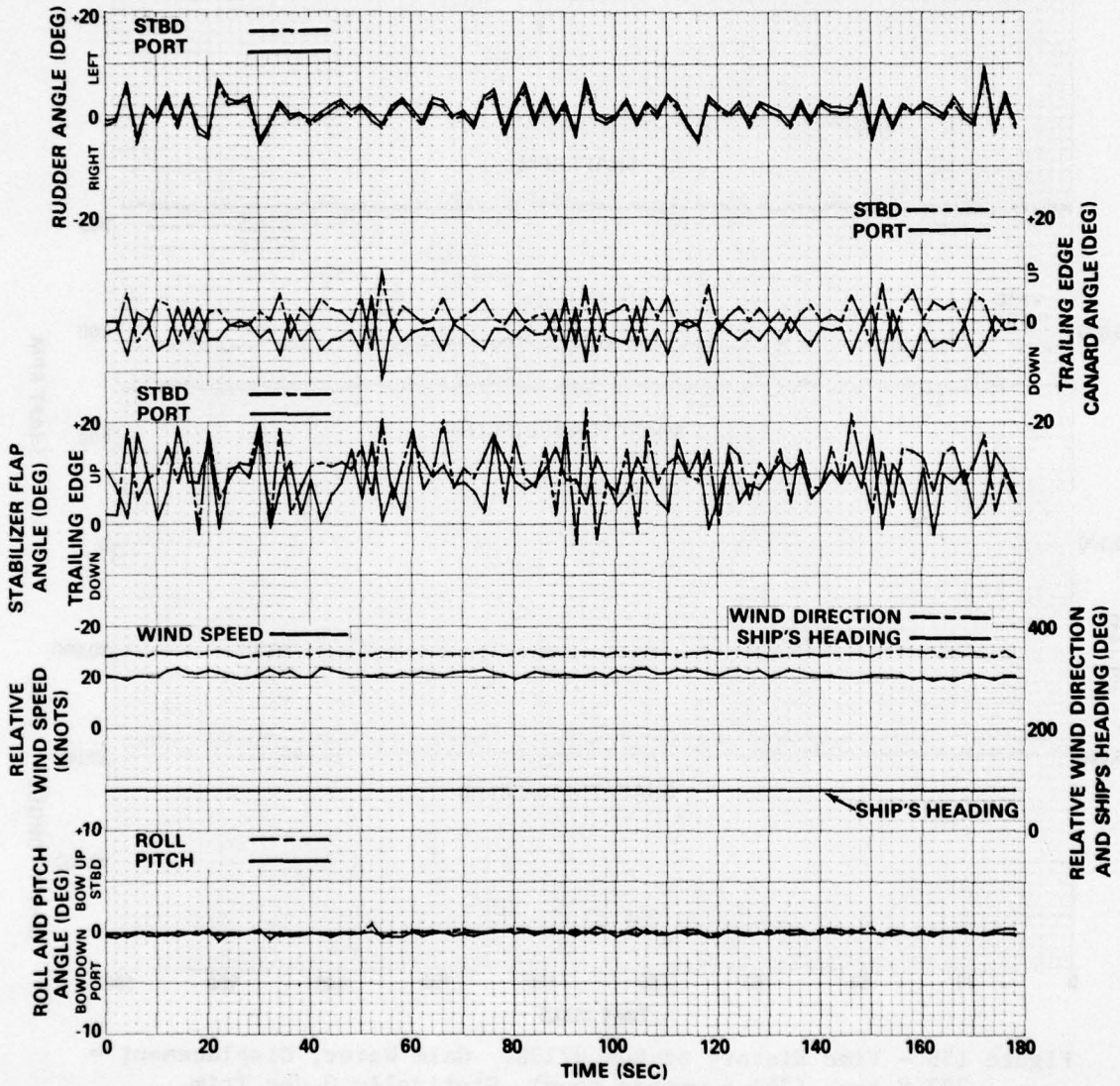

Figure 16a - Time History of Run 0810: Rough Water, Head Seas
Displacement = 228.4 tons (232.1 metric tons),
Statically Trimmed by the Stern, Automatic Control System,
Ship Speed = 11.16 knots

Figure 16 (Continued)

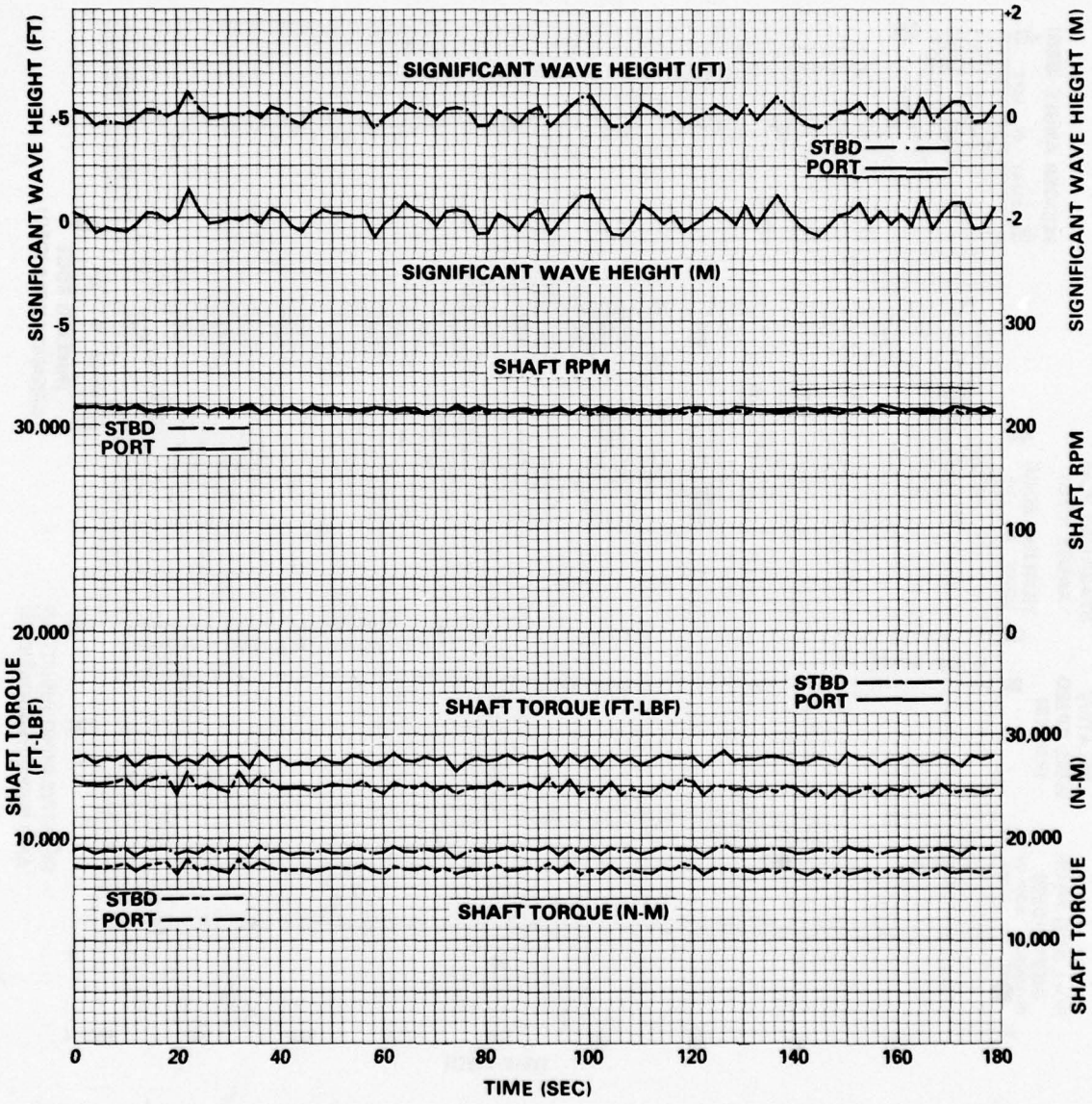

Figure 16b - Time History of Run 0810: Rough Water, Head Seas
Displacement = 228.4 tons (232.1 metric tons),
Statically Trimmed by the Stern, Automatic Control System,
Ship Speed = 11.16 knots

Figure 17 - Time History of Run 0820

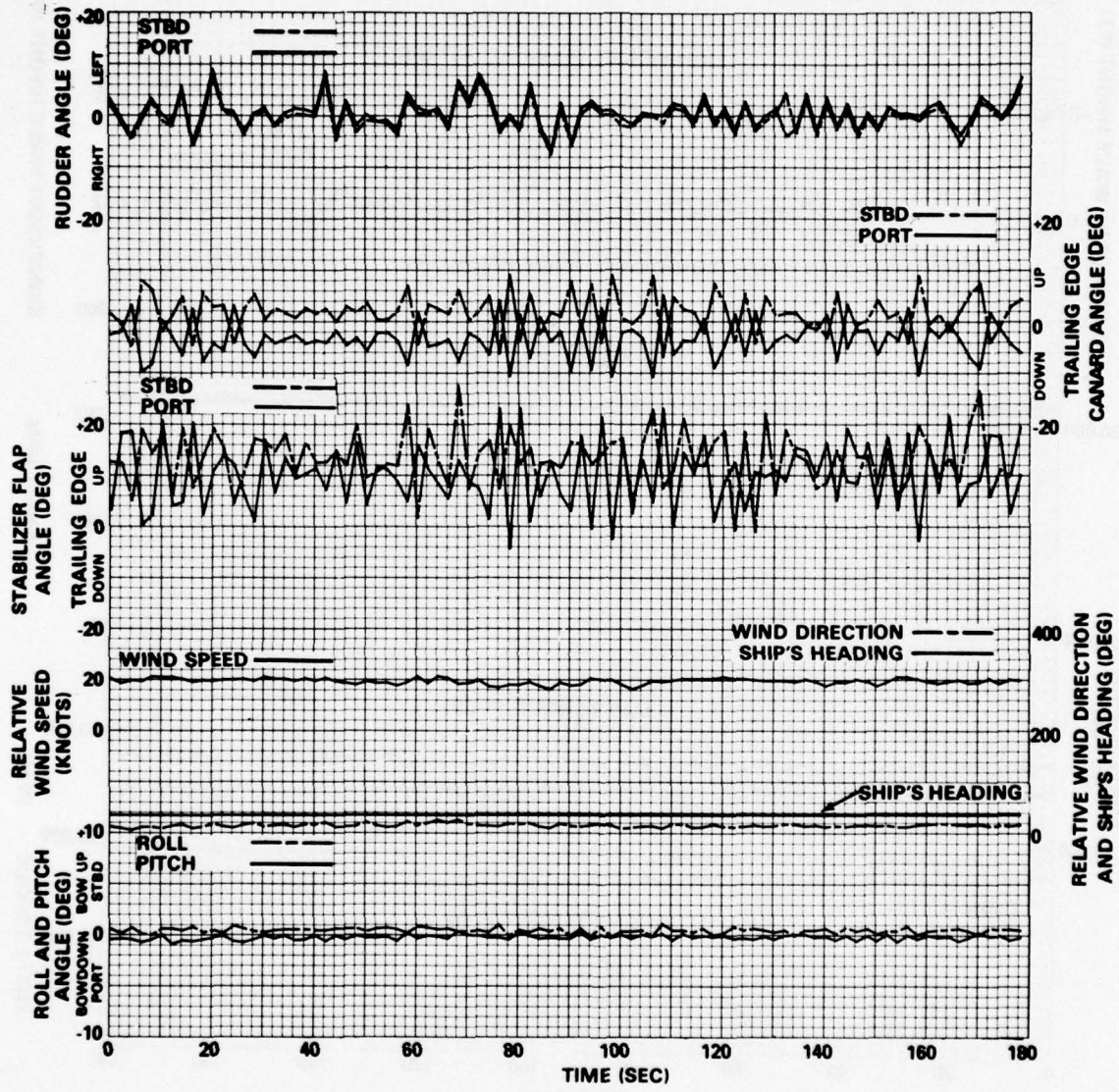

Figure 17a - Time History of Run 0820: Rough Water, Starboard Bow Quartering Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 12.19 knots

Figure 17 (Continued)

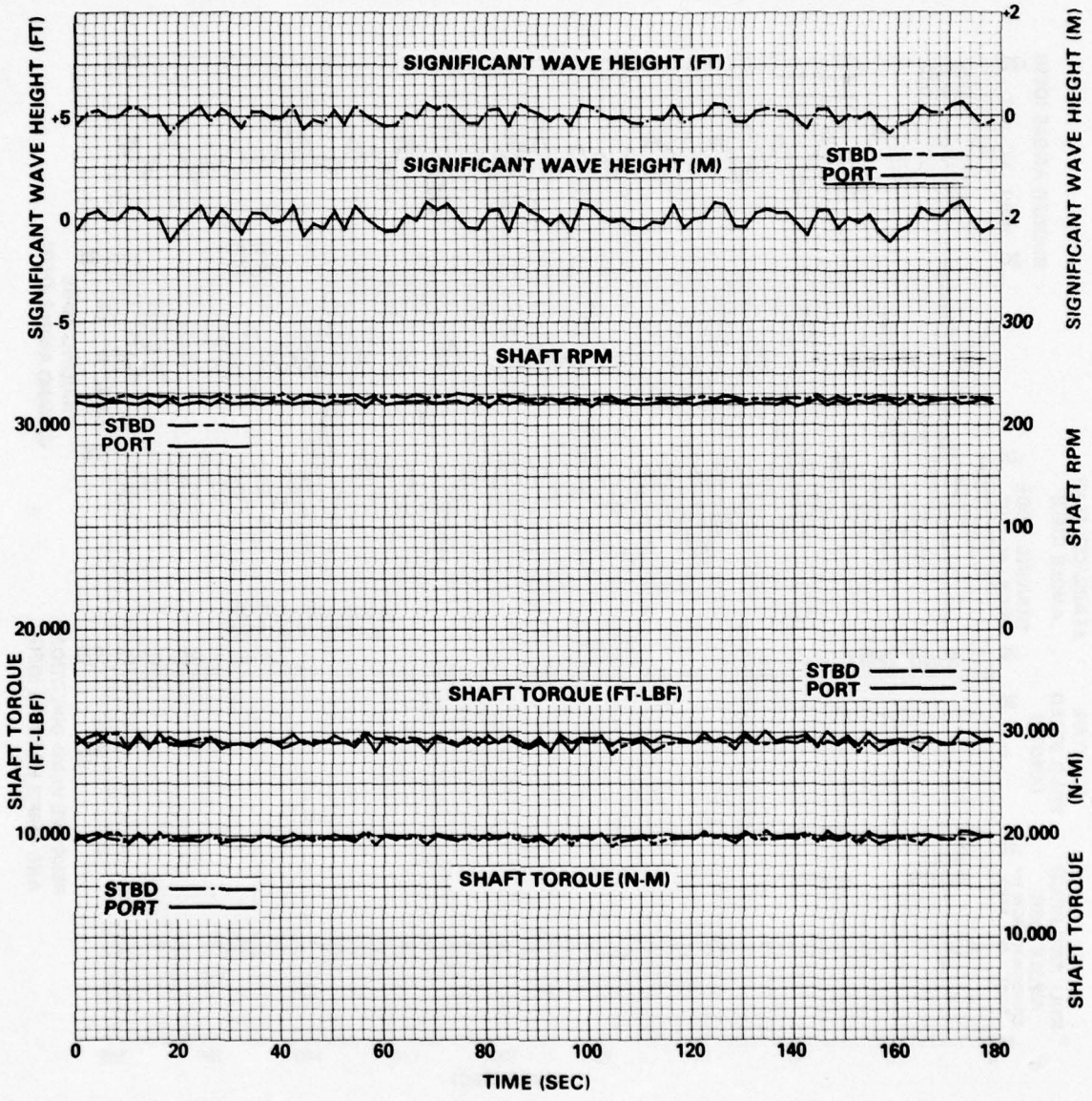

Figure 17b - Time History of Run 0820: Rough Water, Starboard Bow Quartering Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 12.19 knots

Figure 18 - Time History of Run 0830

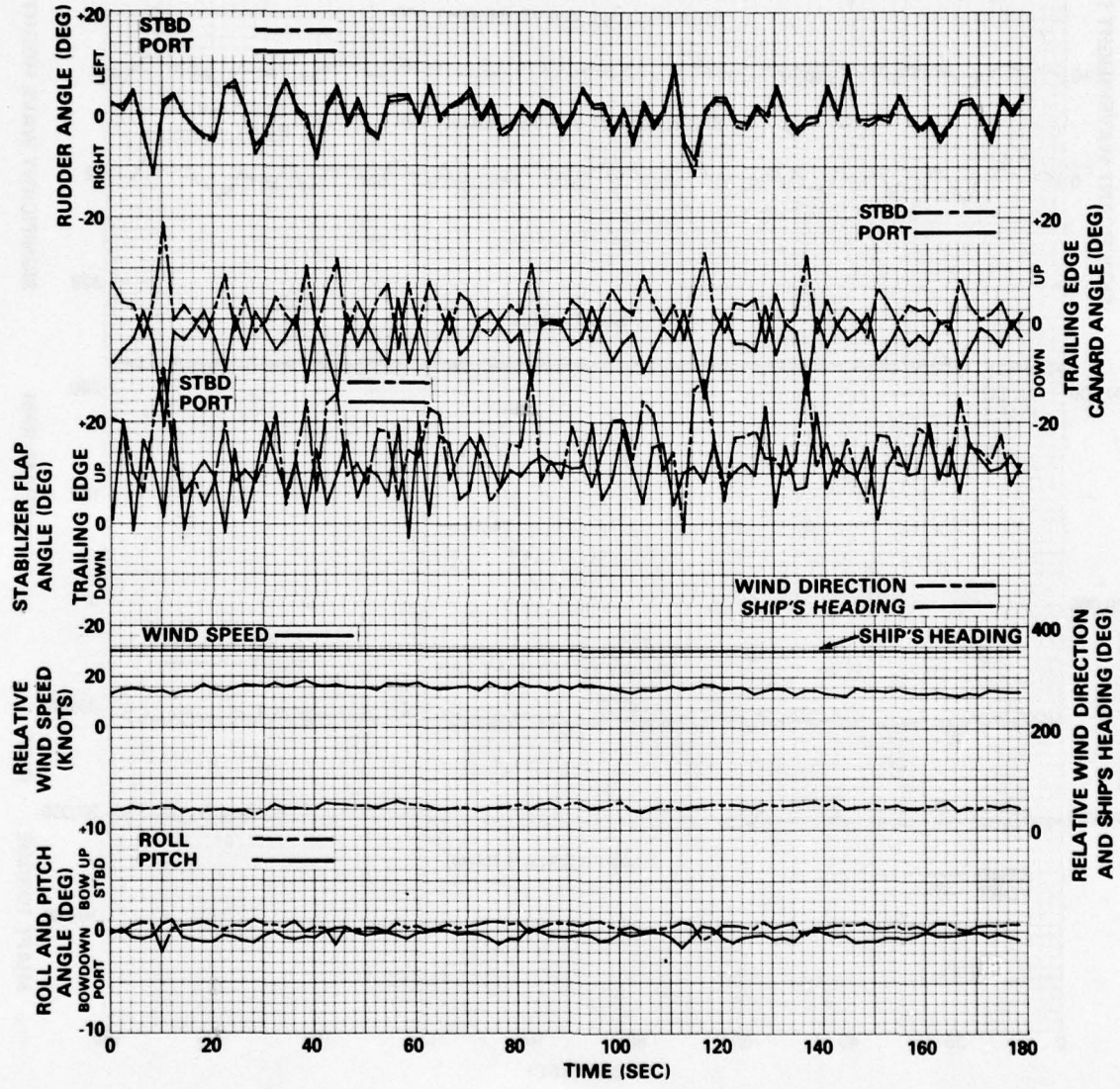

Figure 18a - Time History of Run 0830: Rough Water, Starboard Beam Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 12.65 knots

Figure 18 (Continued)

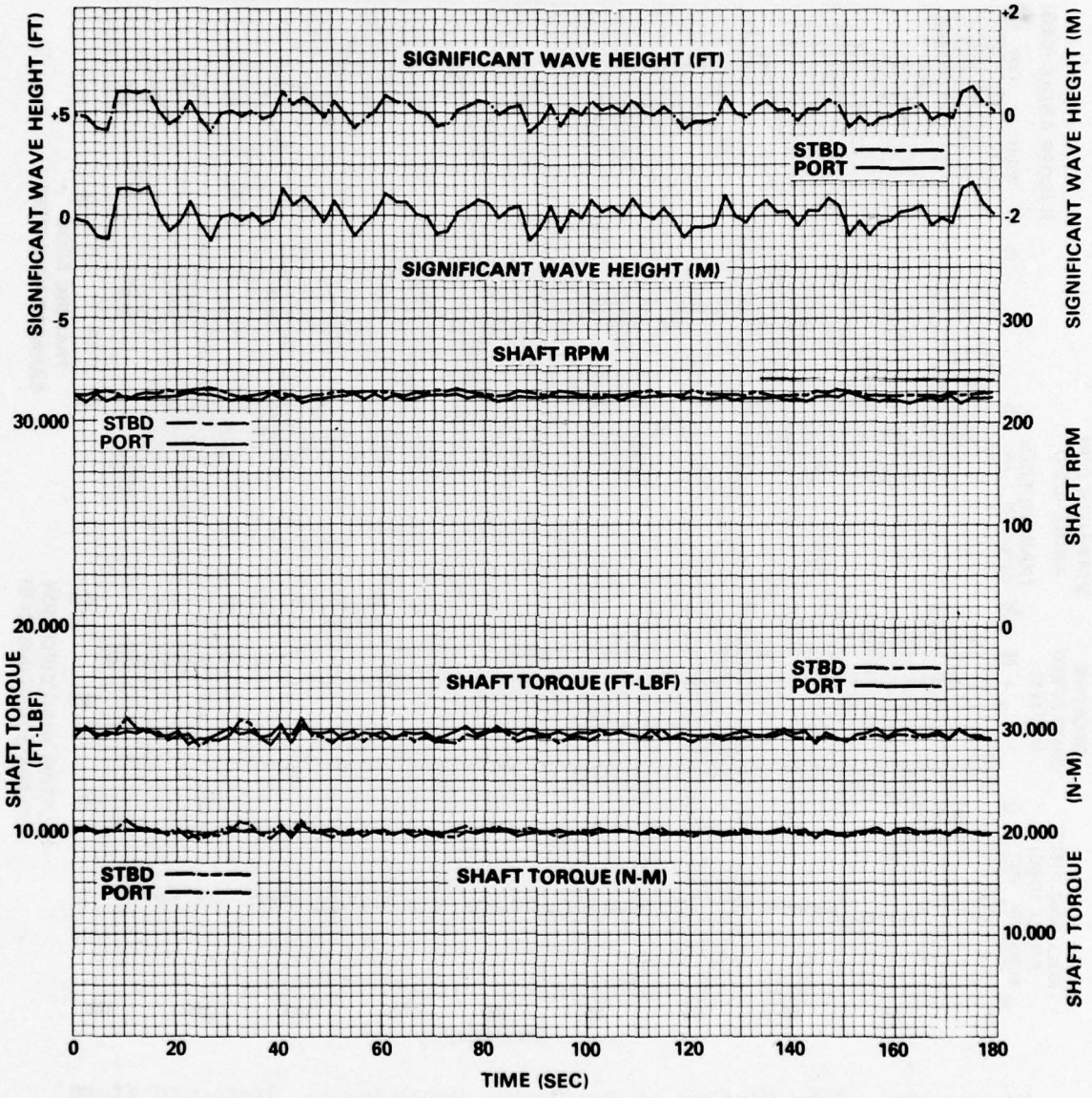

Figure 18b - Time History of Run 0830: Rough Water, Starboard Beam Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 12.65 knots

Figure 19 - Time History of Run 0840

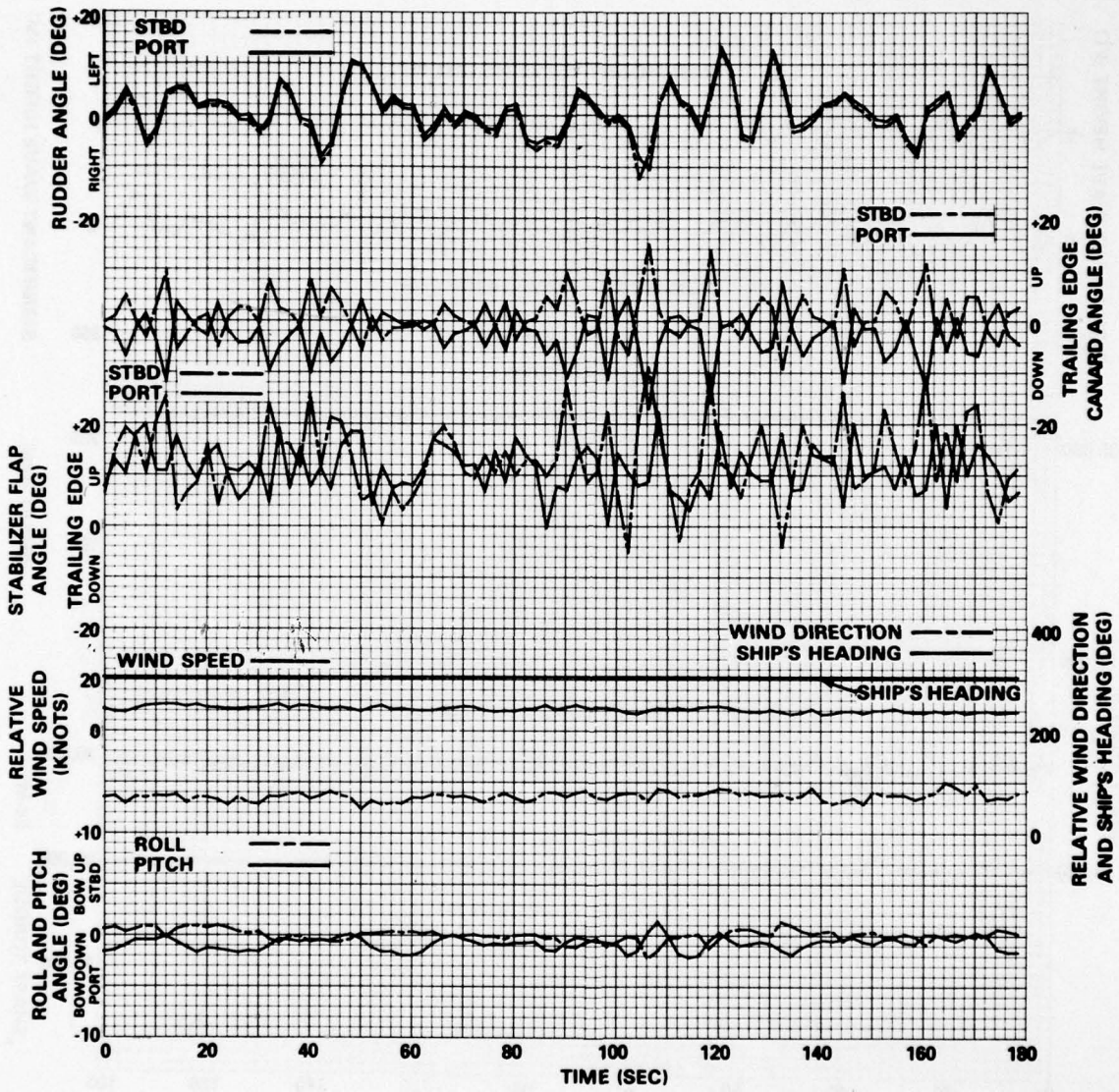

Figure 19a - Time History of Run 0840: Rough Water, Starboard Stern Quartering Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 13.00 knots

Figure 19 (Continued)

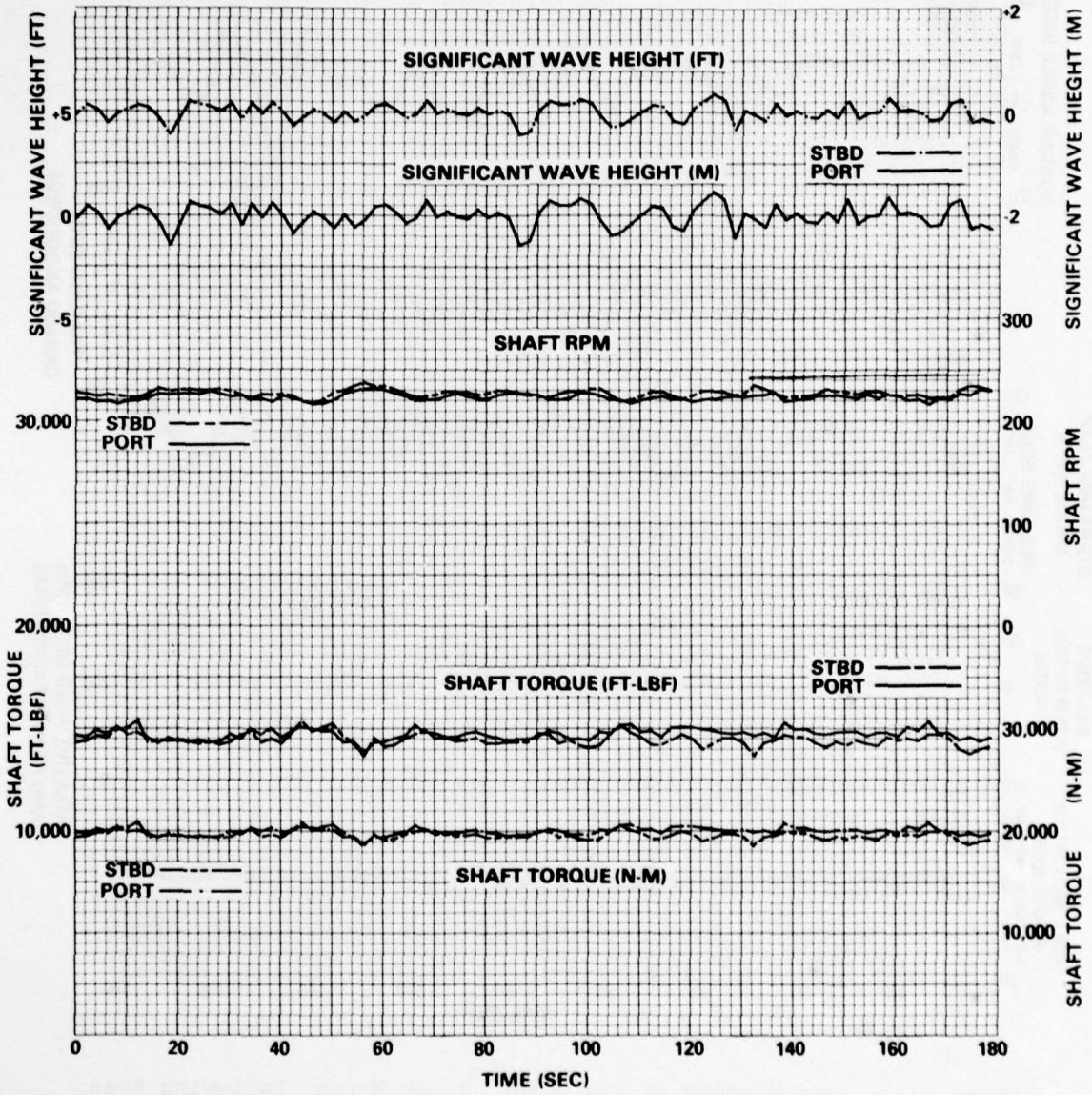

Figure 19b - Time History of Run 0840: Rough Water, Starboard Stern Quartering Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 13.00 knots

Figure 20 - Time History of Run 0850

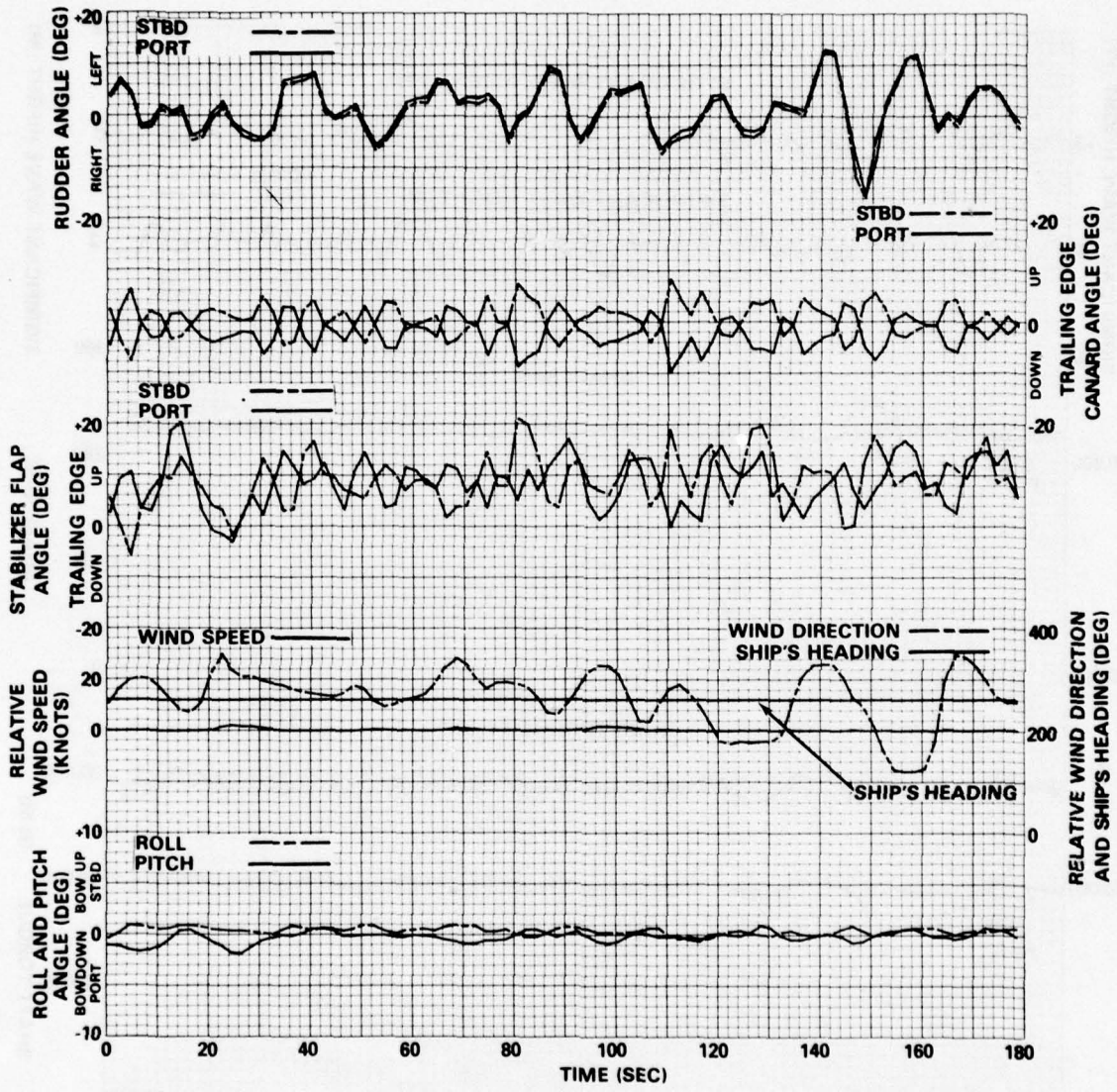

Figure 20a - Time History of Run 0850: Rough Water, Following Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 13.06 knots

Figure 20 (Continued)

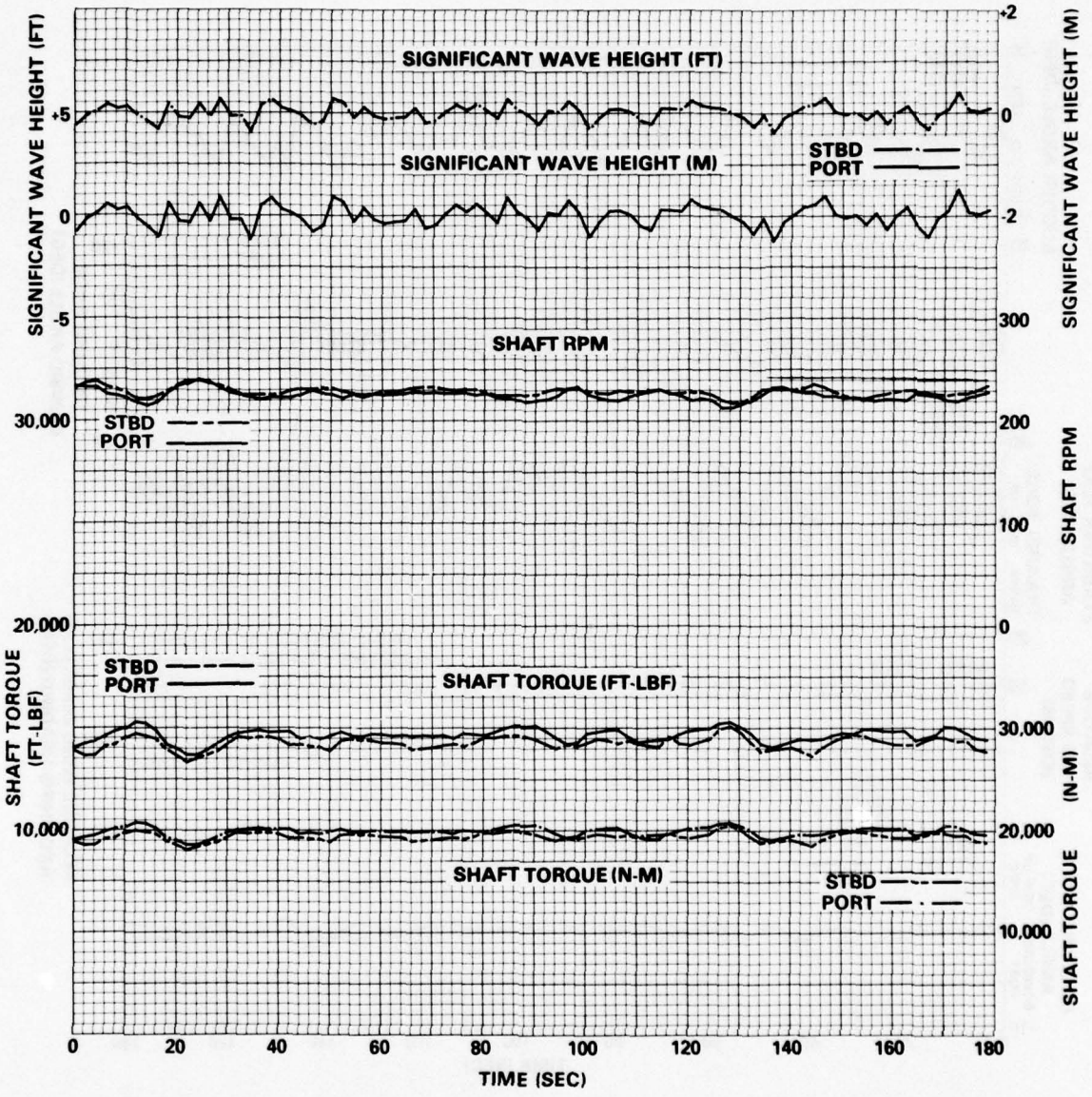

Figure 20b - Time History of Run 0850: Rough Water, Following Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 13.06 knots

Figure 21 - Time History of Run 0860

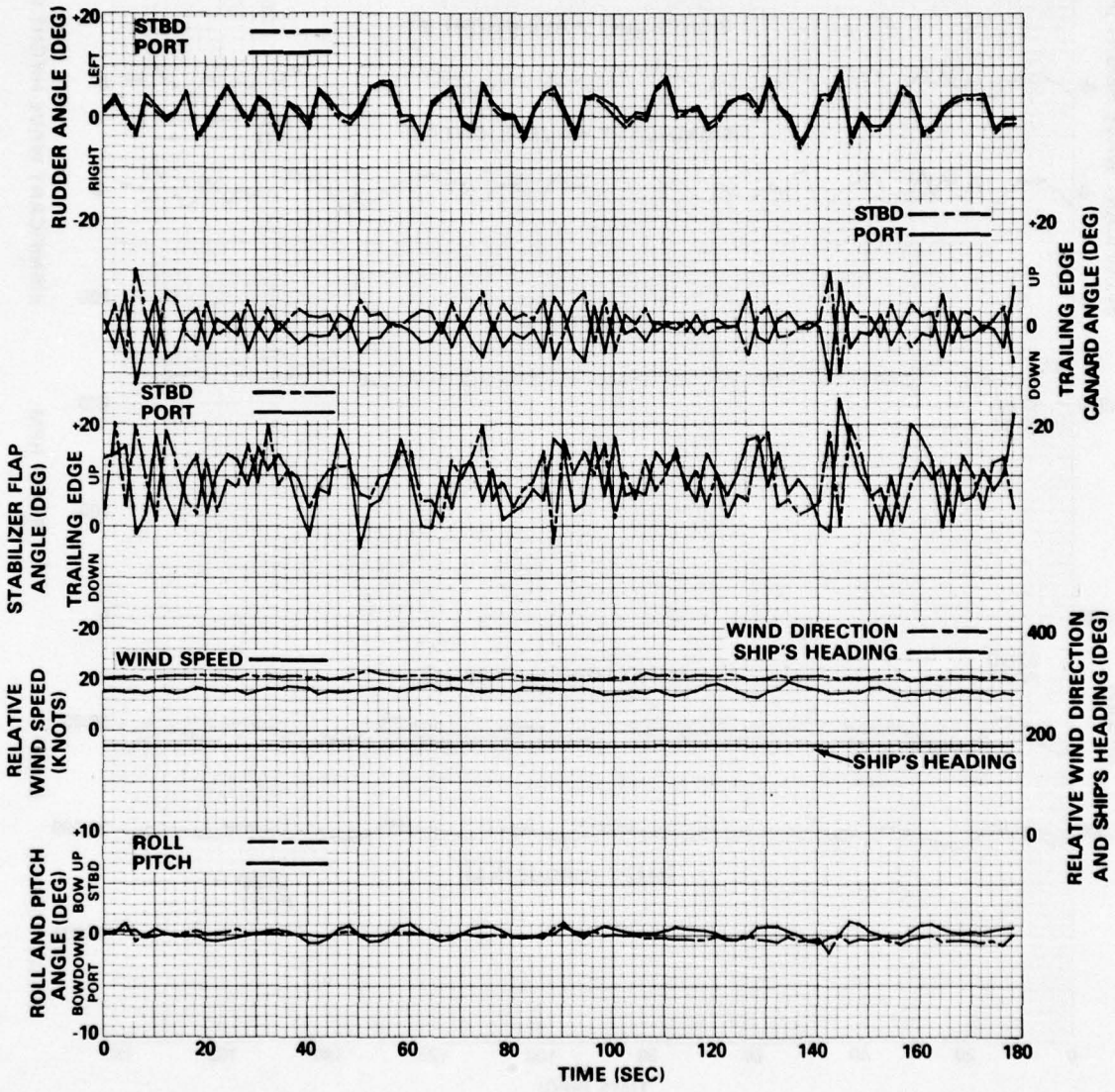

Figure 21a - Time History of Run 0860: Rough Water, Port Beam Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 11.96 knots

Figure 21 (Continued)

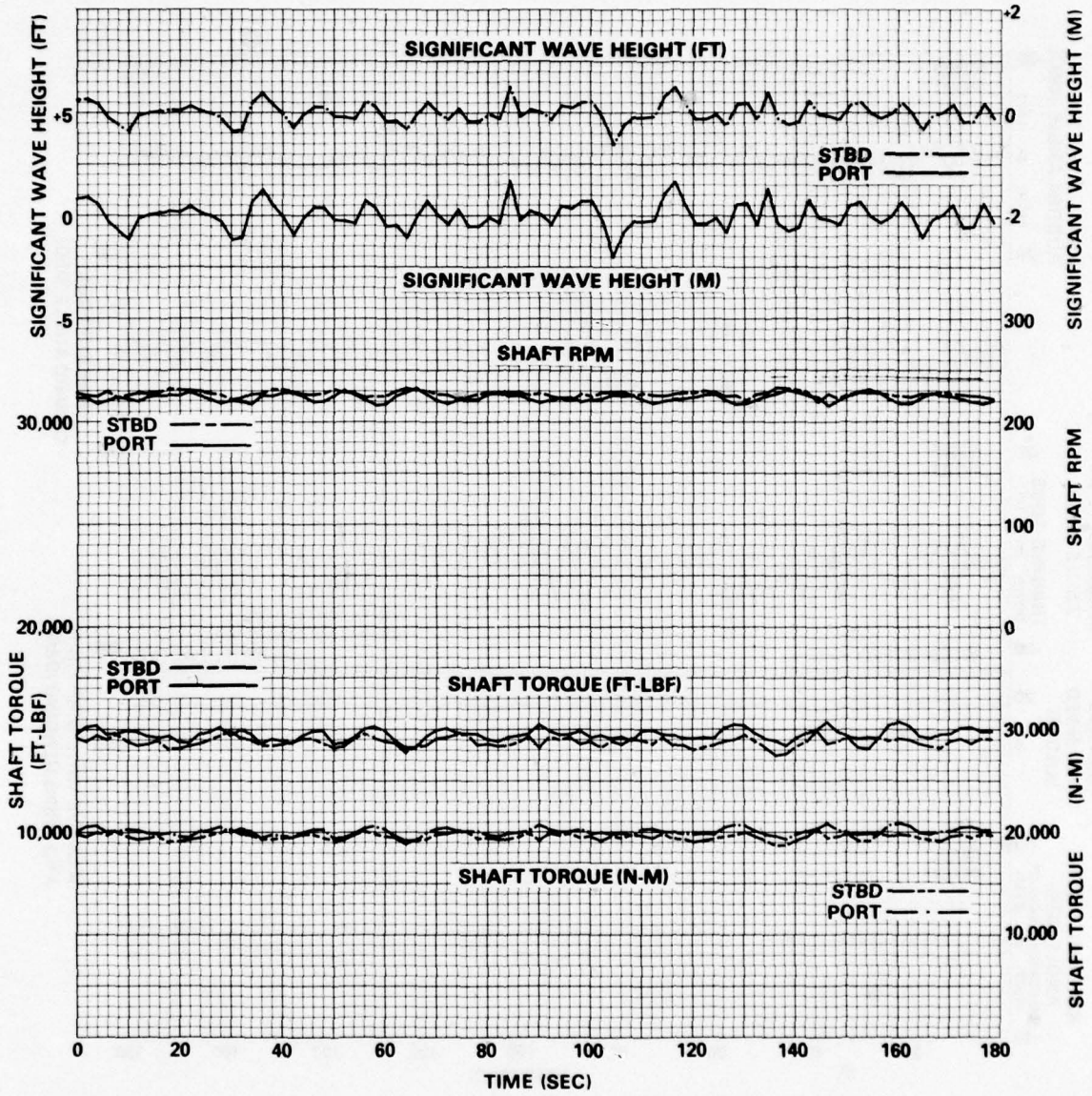

Figure 21b - Time History of Run 0860: Rough Water, Port Beam Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 11.96 knots

Figure 22 - Time History of Run 0950

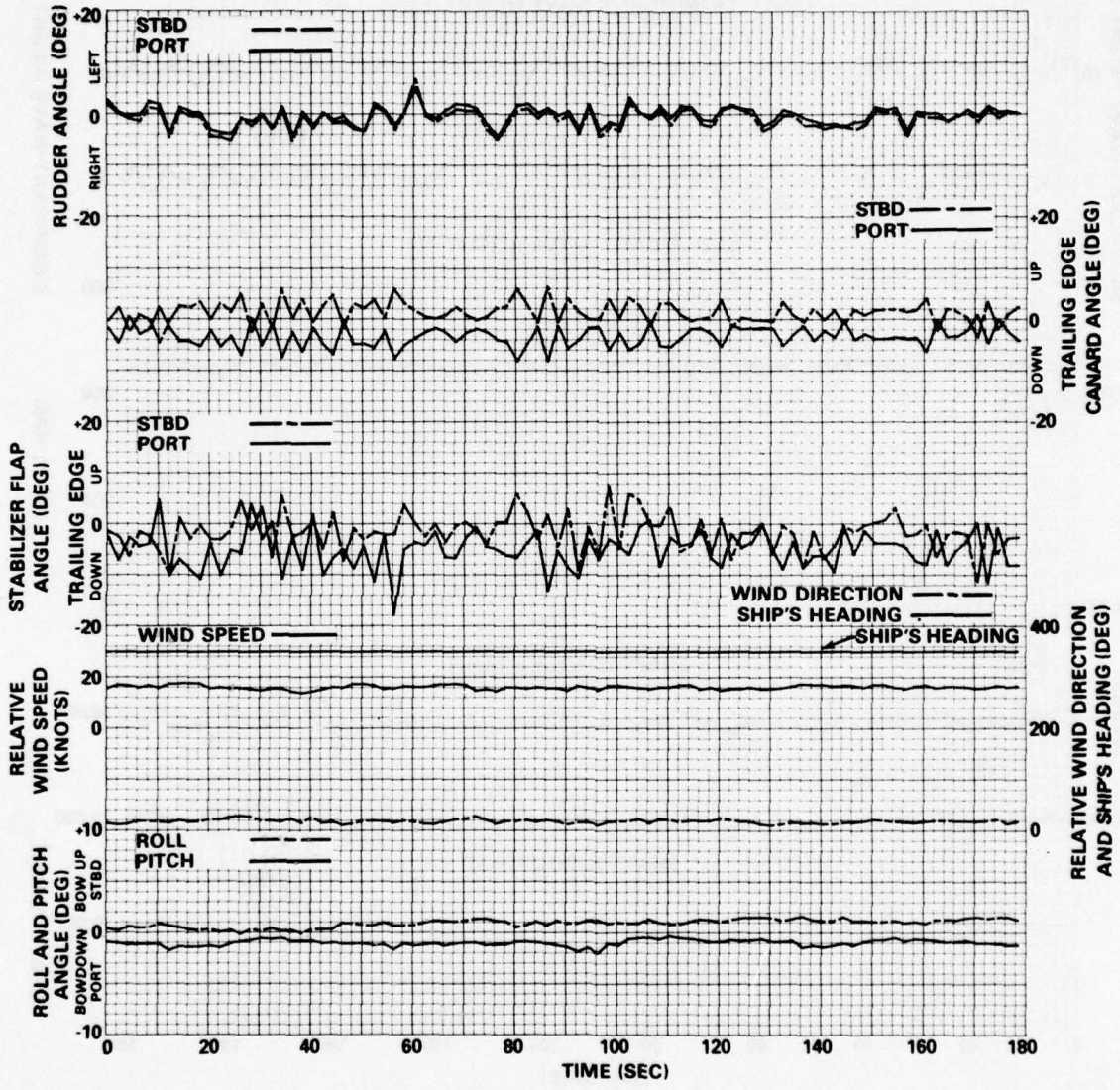

Figure 22a - Time History of Run 0950: Rough Water, Starboard Beam Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 18.32 knots

Figure 22 (Continued)

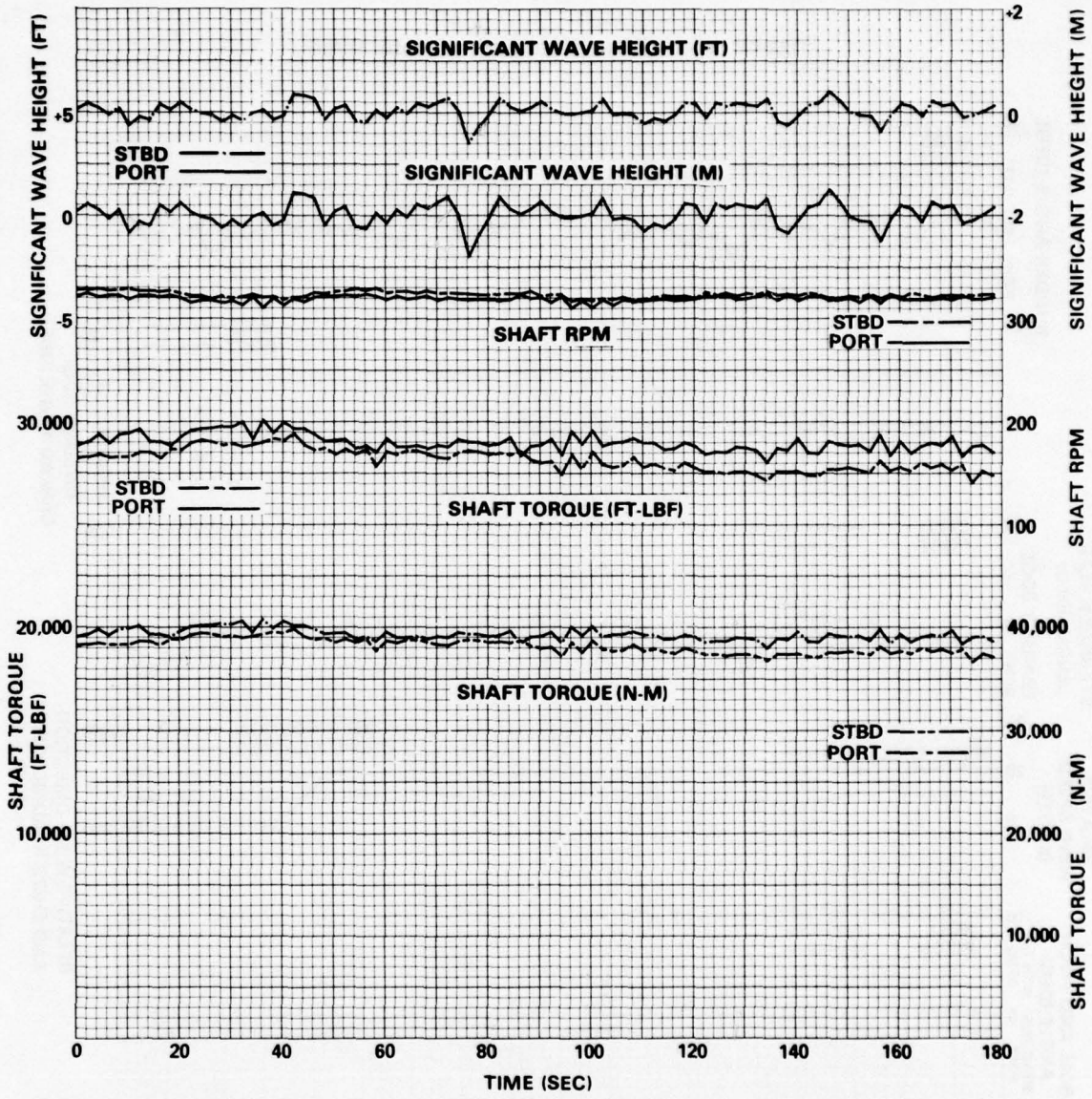

Figure 22b - Time History of Run 0950: Rough Water, Starboard Beam Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 18.32 knots

Figure 23 - Time History of Run 0960

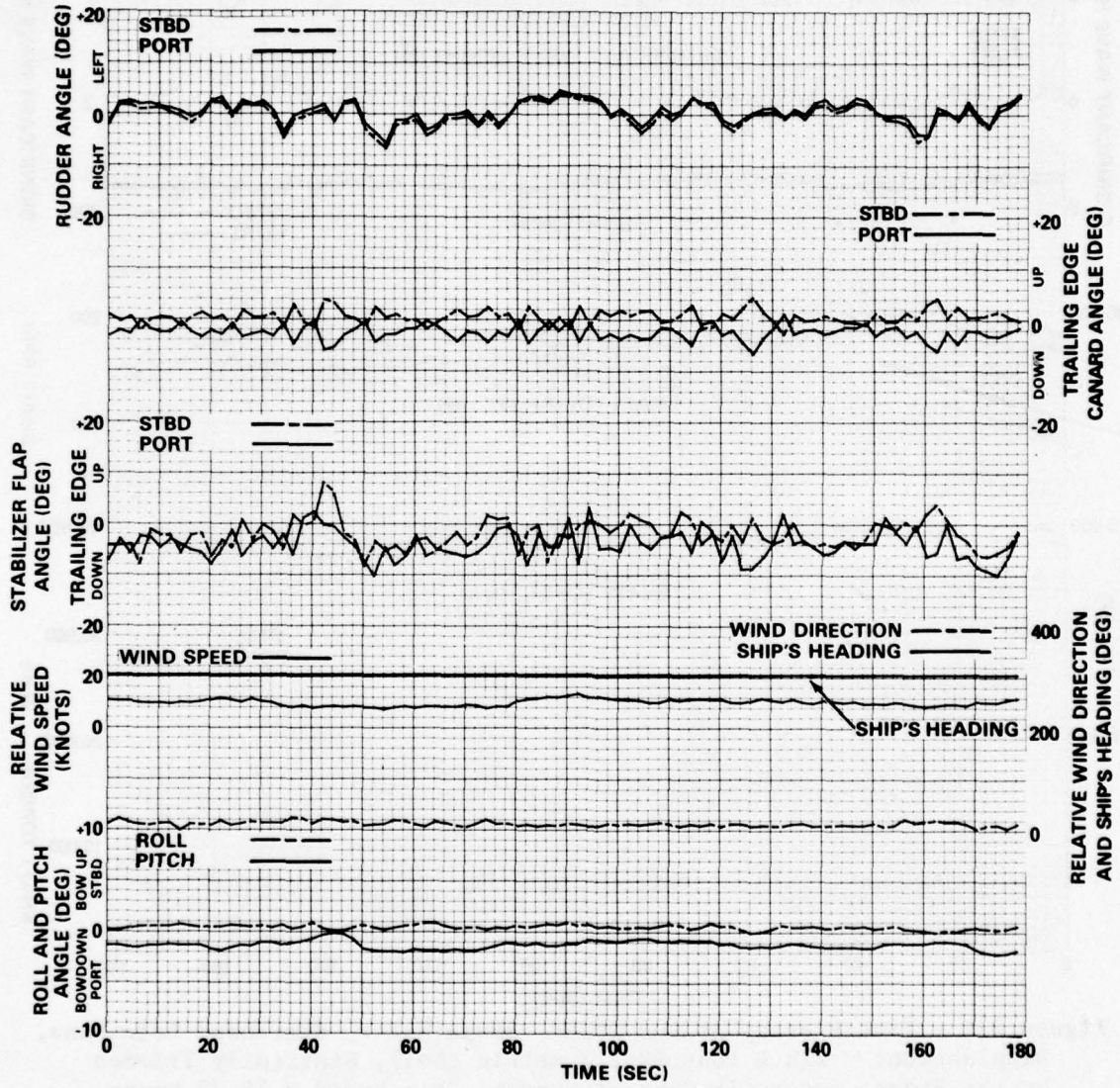

Figure 23a - Time History of Run 0960: Rough Water, Starboard Stern Quartering Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 19.53 knots

Figure 23 (Continued)

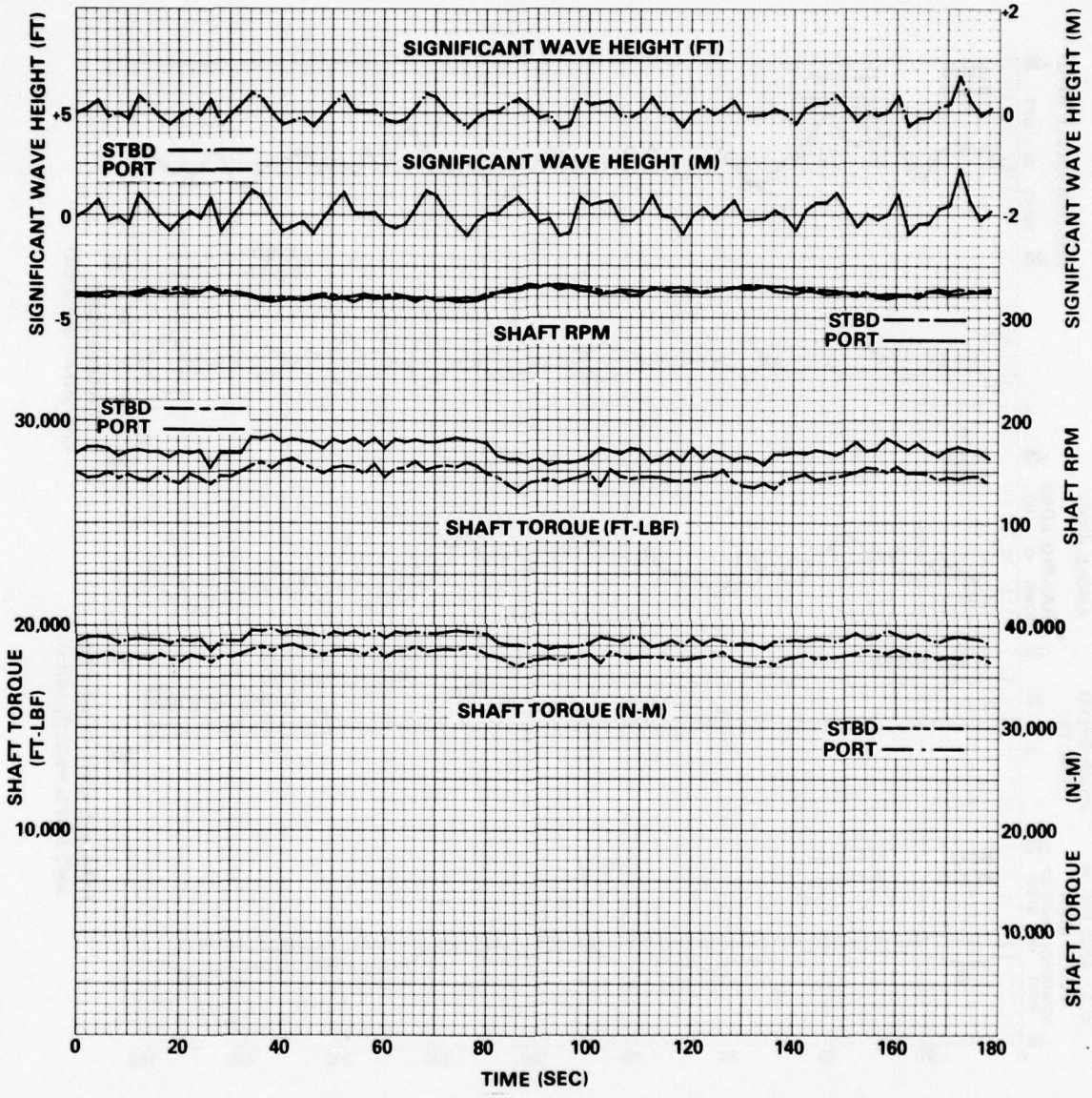

Figure 23b - Time History of Run 0960: Rough Water, Starboard Stern Quartering Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 19.53 knots

Figure 24 - Time History of Run 0970

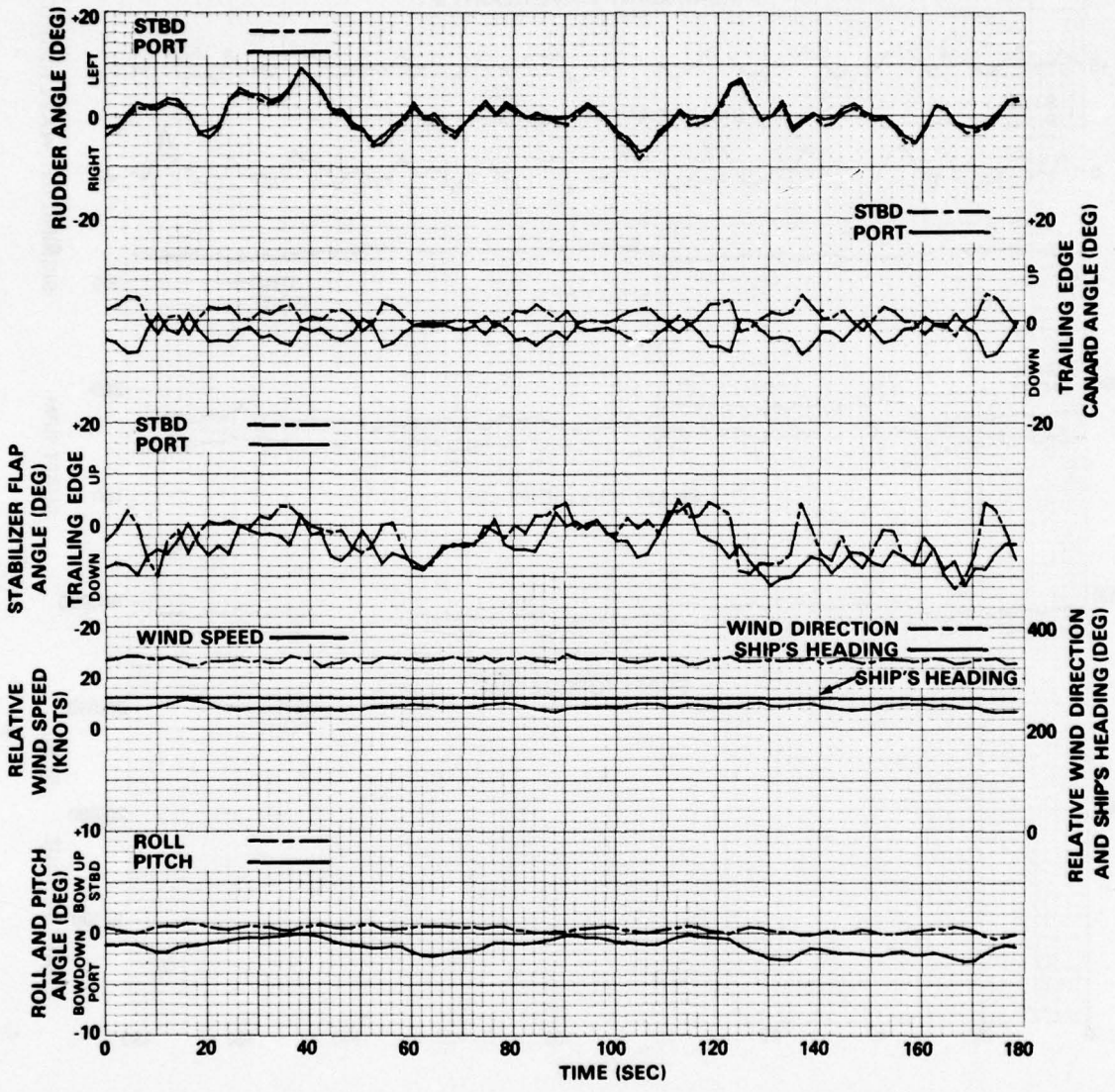

Figure 24a - Time History of Run 0970: Rough Water, Following Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 19.50 knots

Figure 24 (Continued)

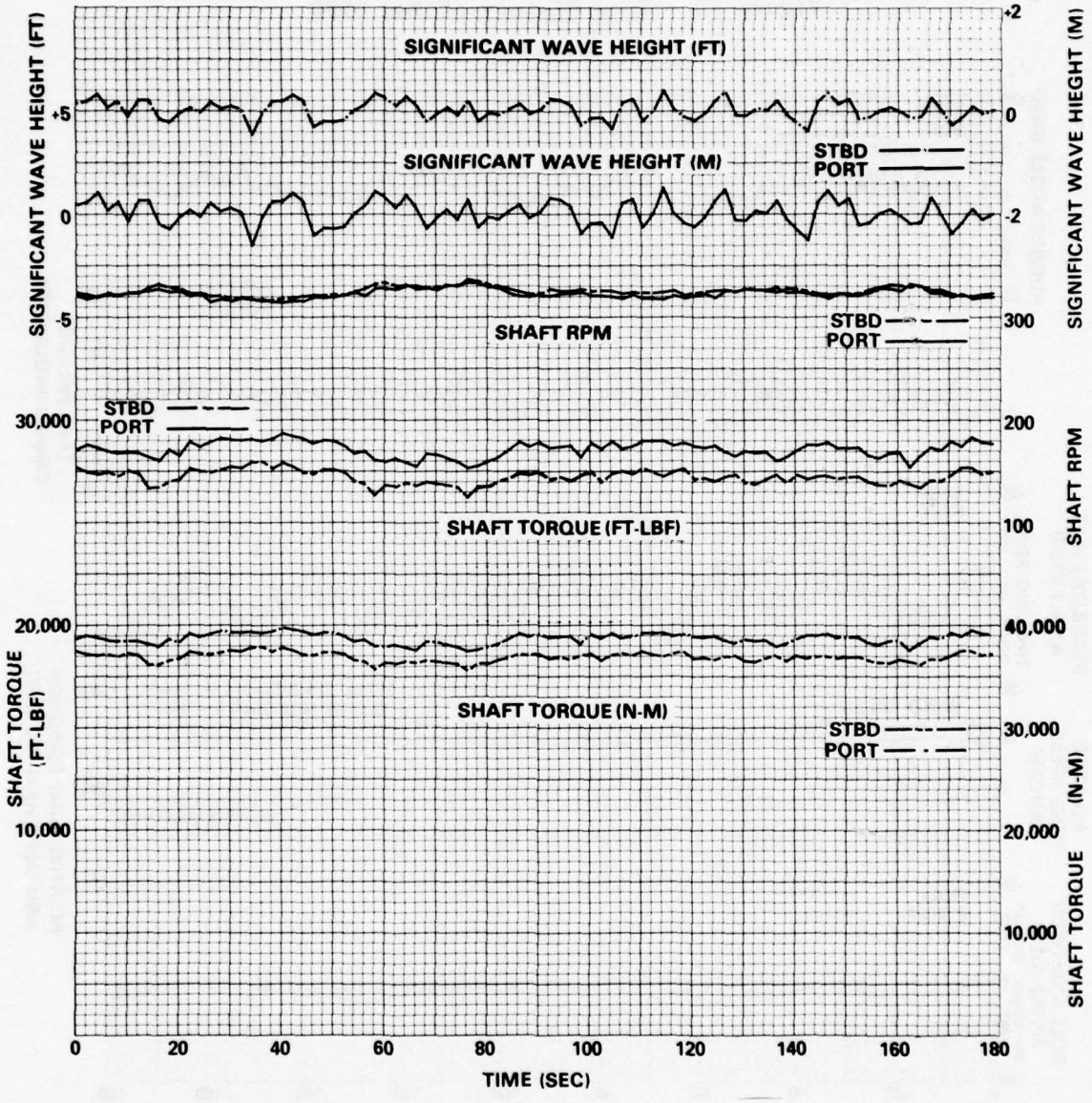

Figure 24b - Time History of Run 0970: Rough Water, Following Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 19.50 knots

Figure 25 - Time History of Run 0980

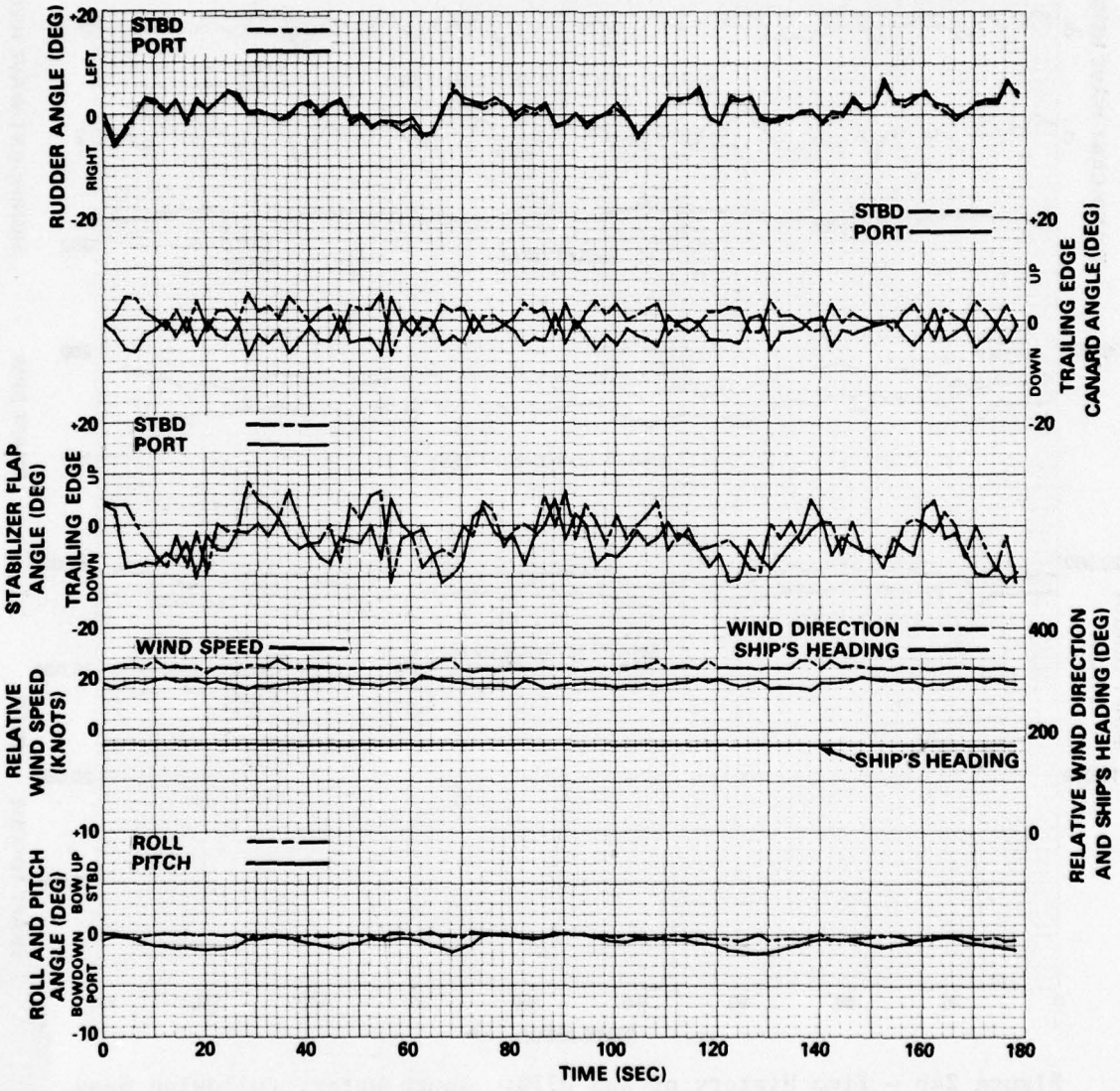

Figure 25a - Time History of Run 0980: Rough Water, Port Beam Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 17.34 knots

Figure 25 (Continued)

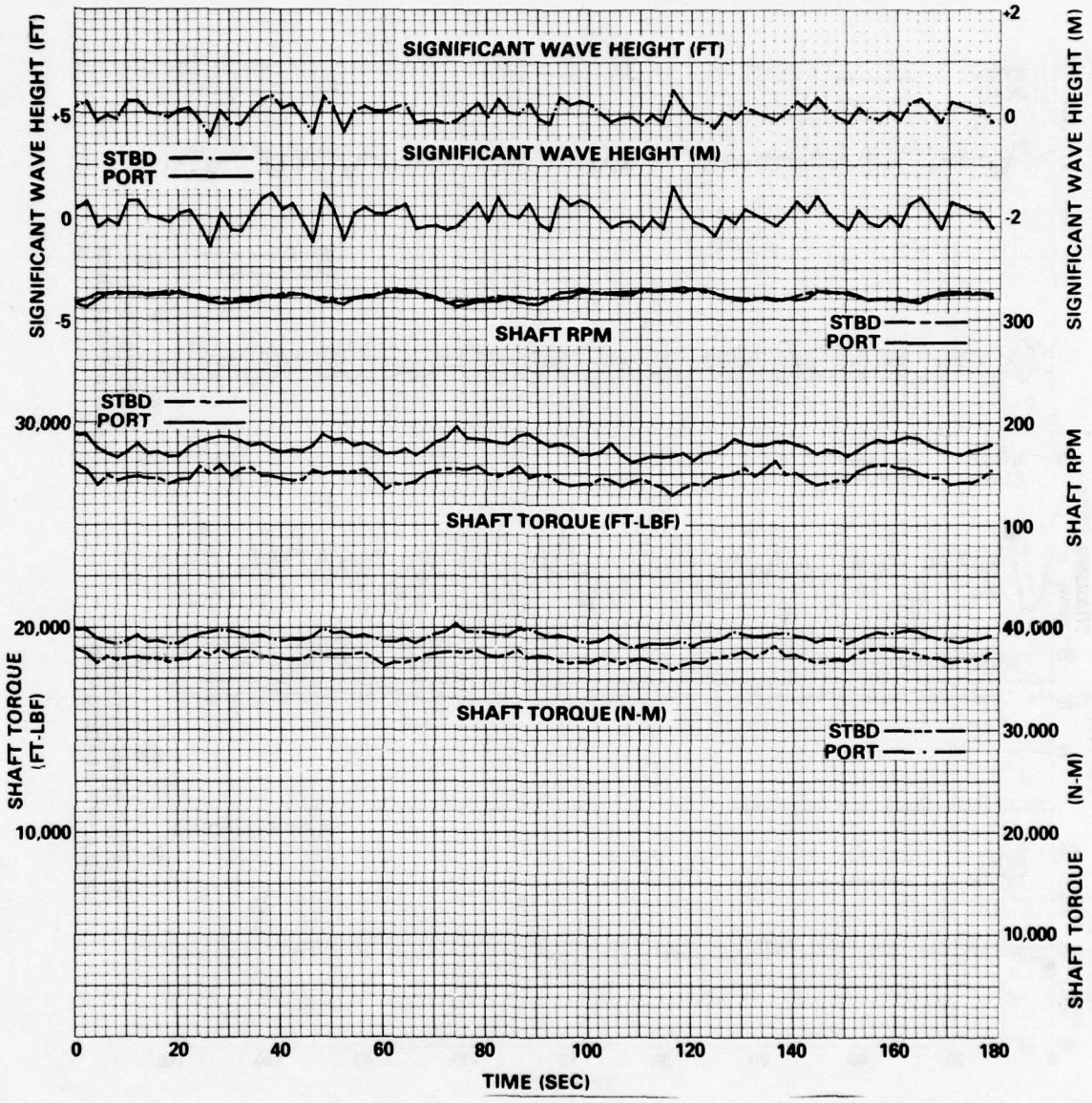

Figure 25b - Time History of Run 0980: Rough Water, Port Beam Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 17.34 knots

Figure 26 - Time History of Run 0990

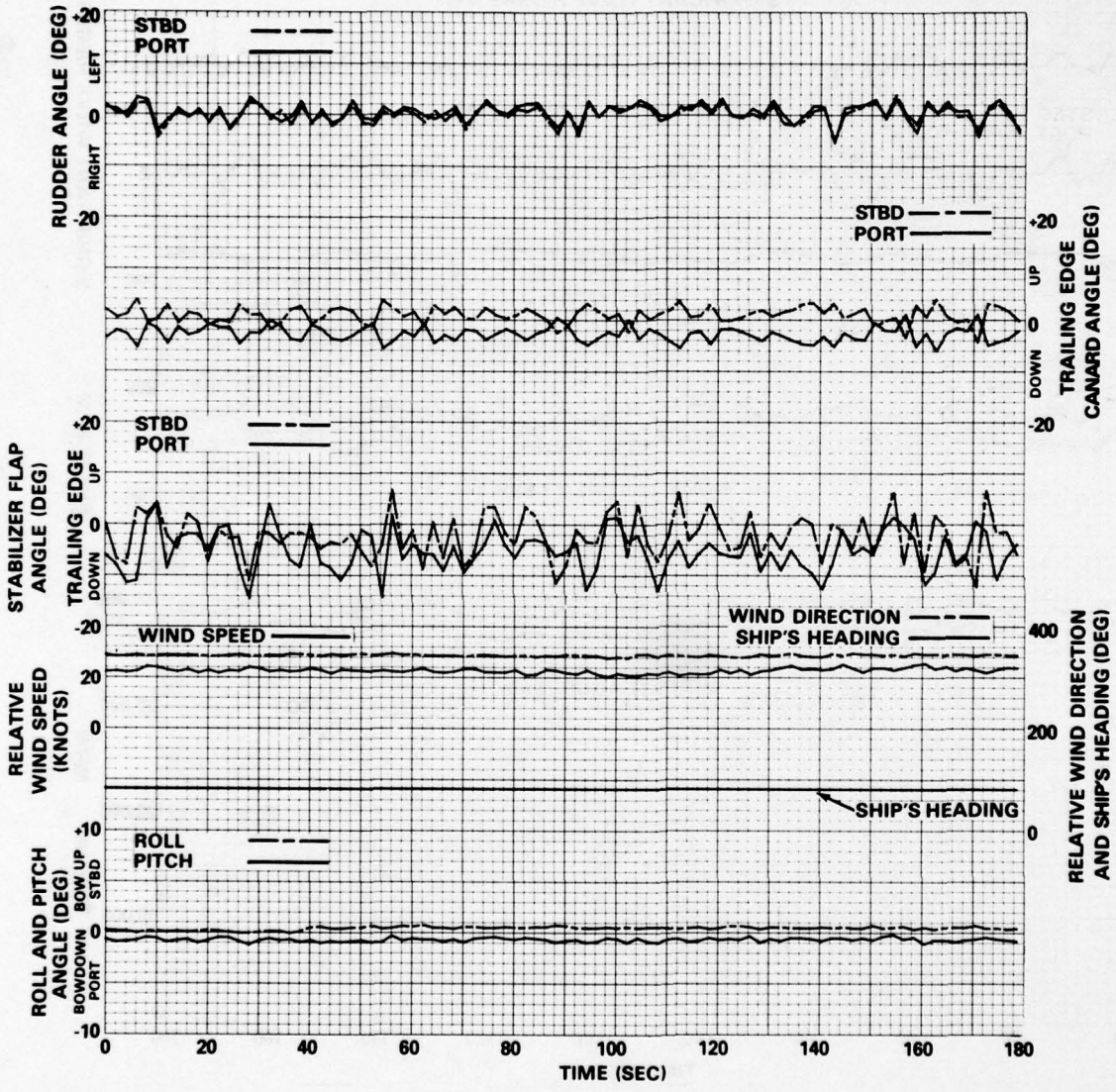

Figure 26a - Time History of Run 0990: Rough Water, Head Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 17.52 knots

Figure 26 (Continued)

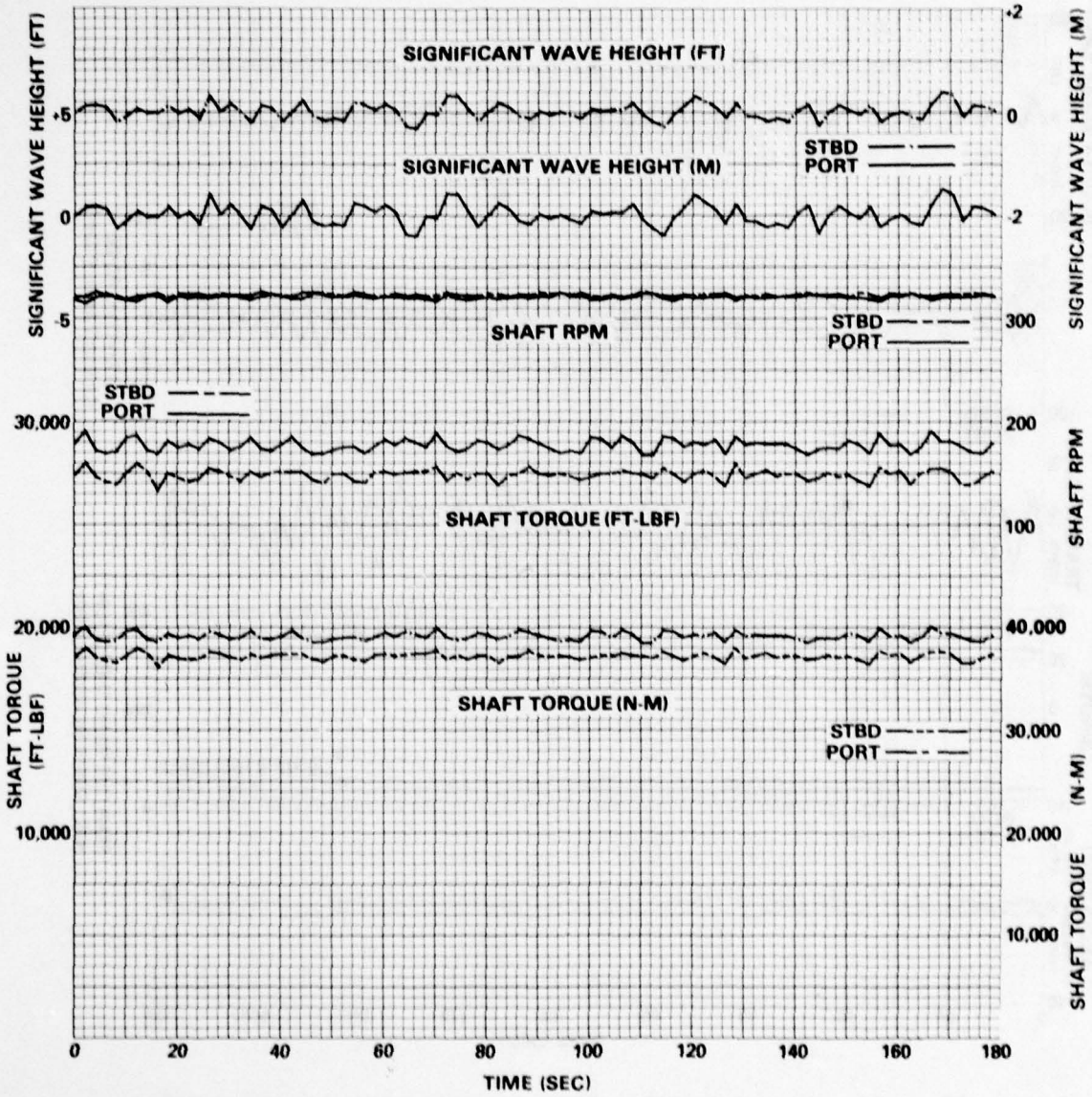

Figure 26b - Time History of Run 0990: Rough Water, Head Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 17.52 knots

Figure 27 - Time History of Run 1000

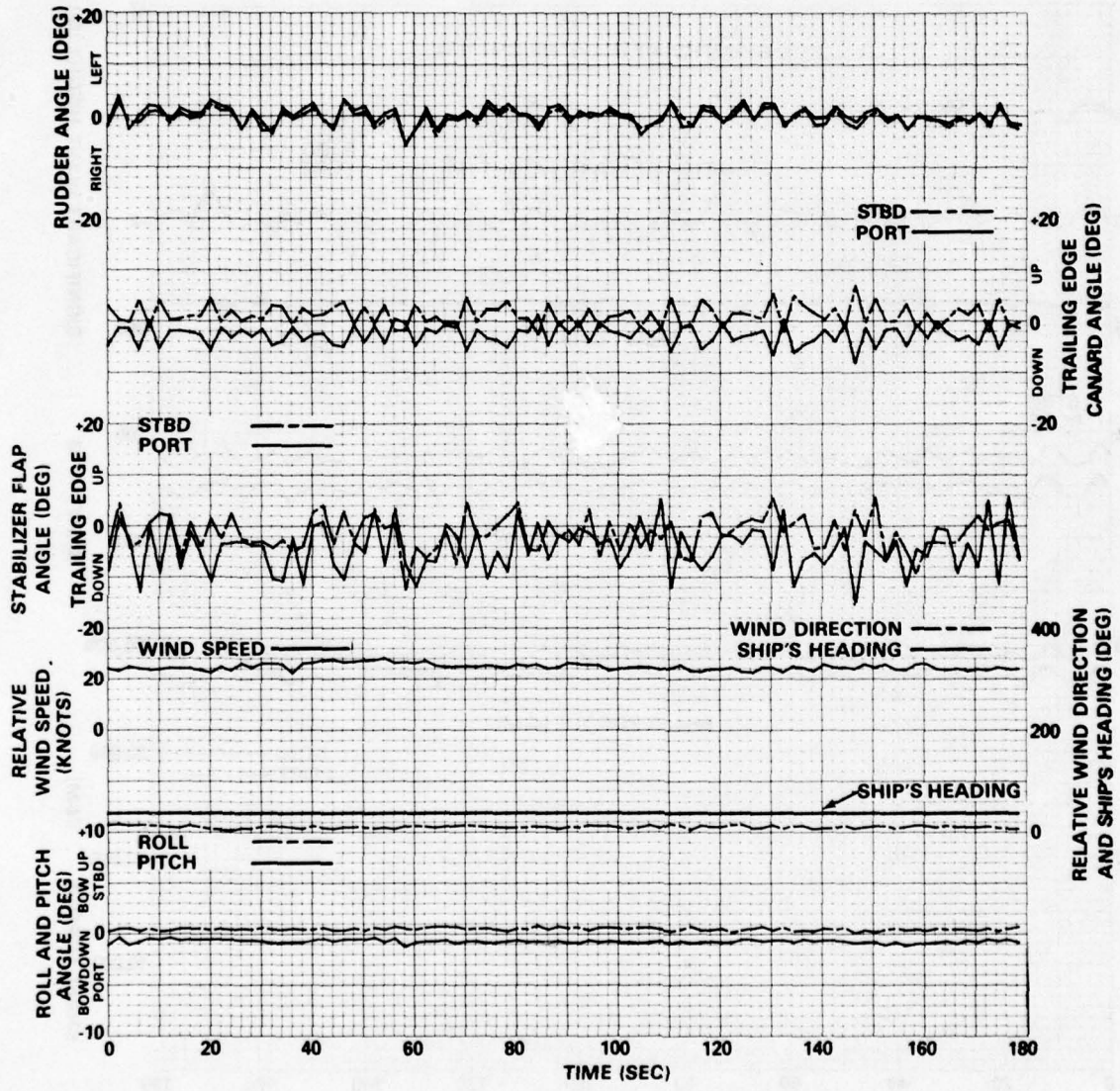

Figure 27a - Time History of Run 1000: Rough Water, Starboard Bow Quartering Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 18.01 knots

Figure 27 (Continued)

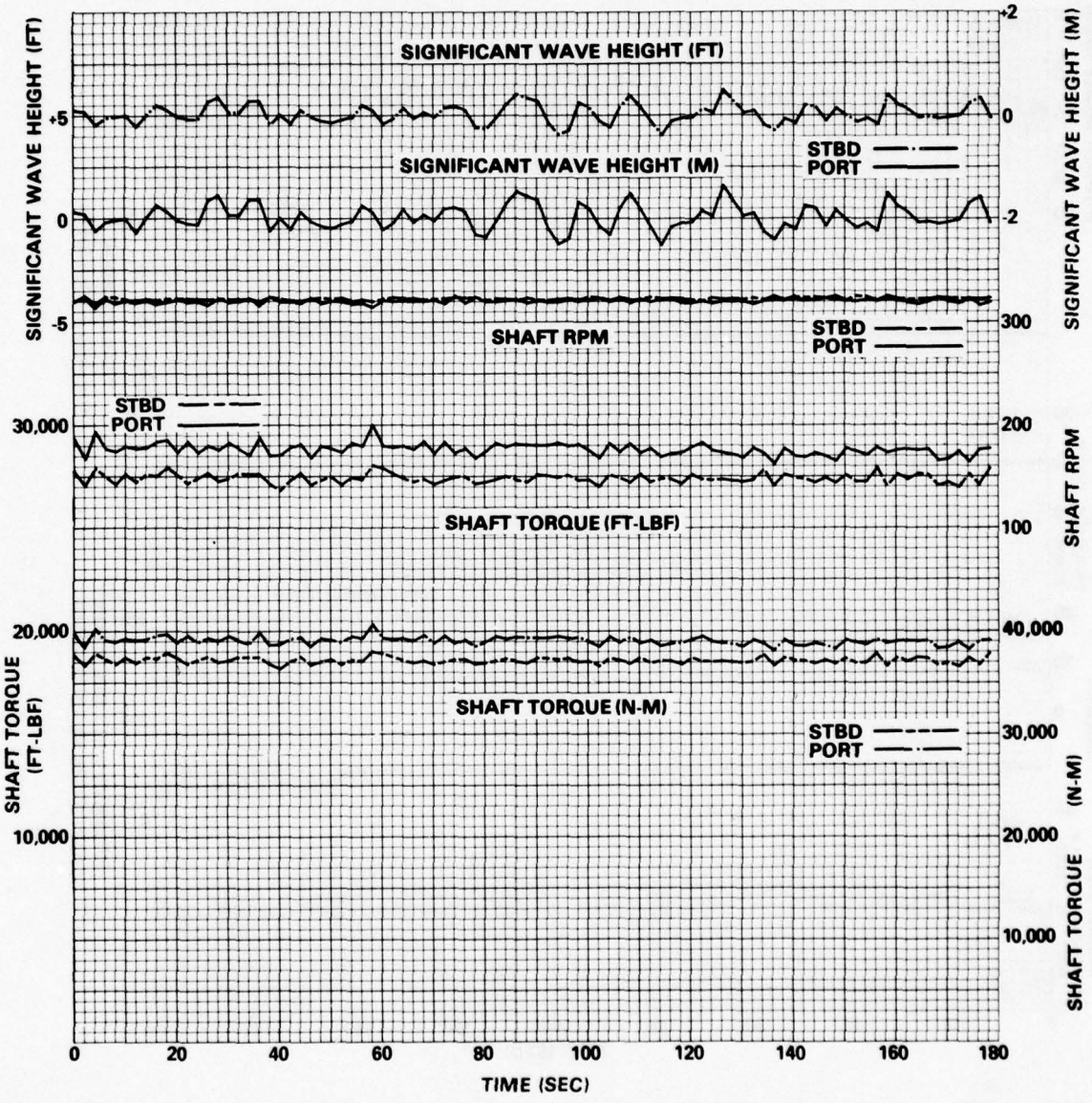

Figure 27b - Time History of Run 1000: Rough Water, Starboard Bow Quartering Seas, Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System, Ship Speed = 18.01 knots

Figure 28 - Time History of Run 1140

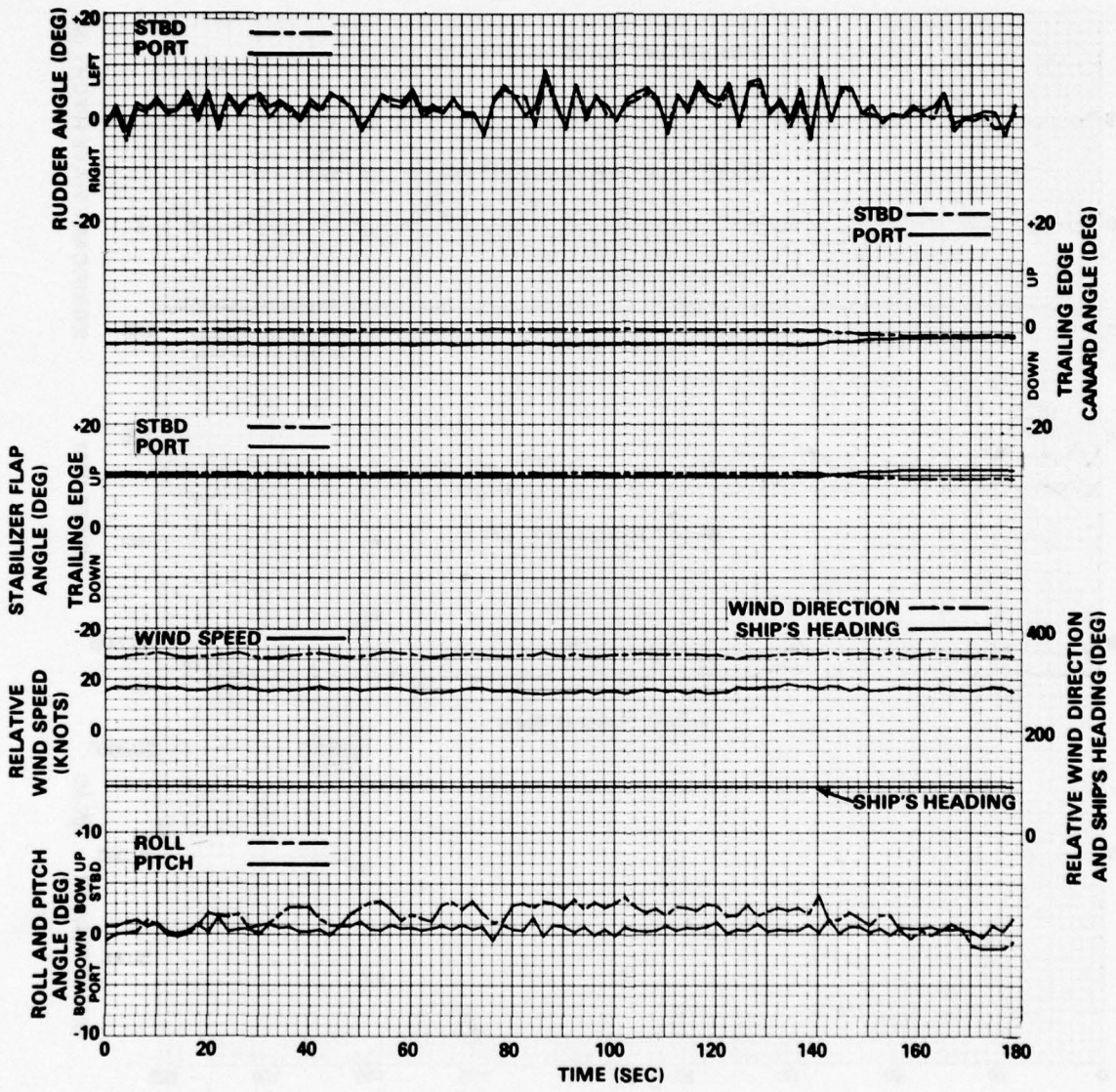

Figure 28a - Time History of Run 1140: Rough Water, Head Seas, Displacement = 215.0 tons (218.4 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 11.37 knots

Figure 28 (Continued)

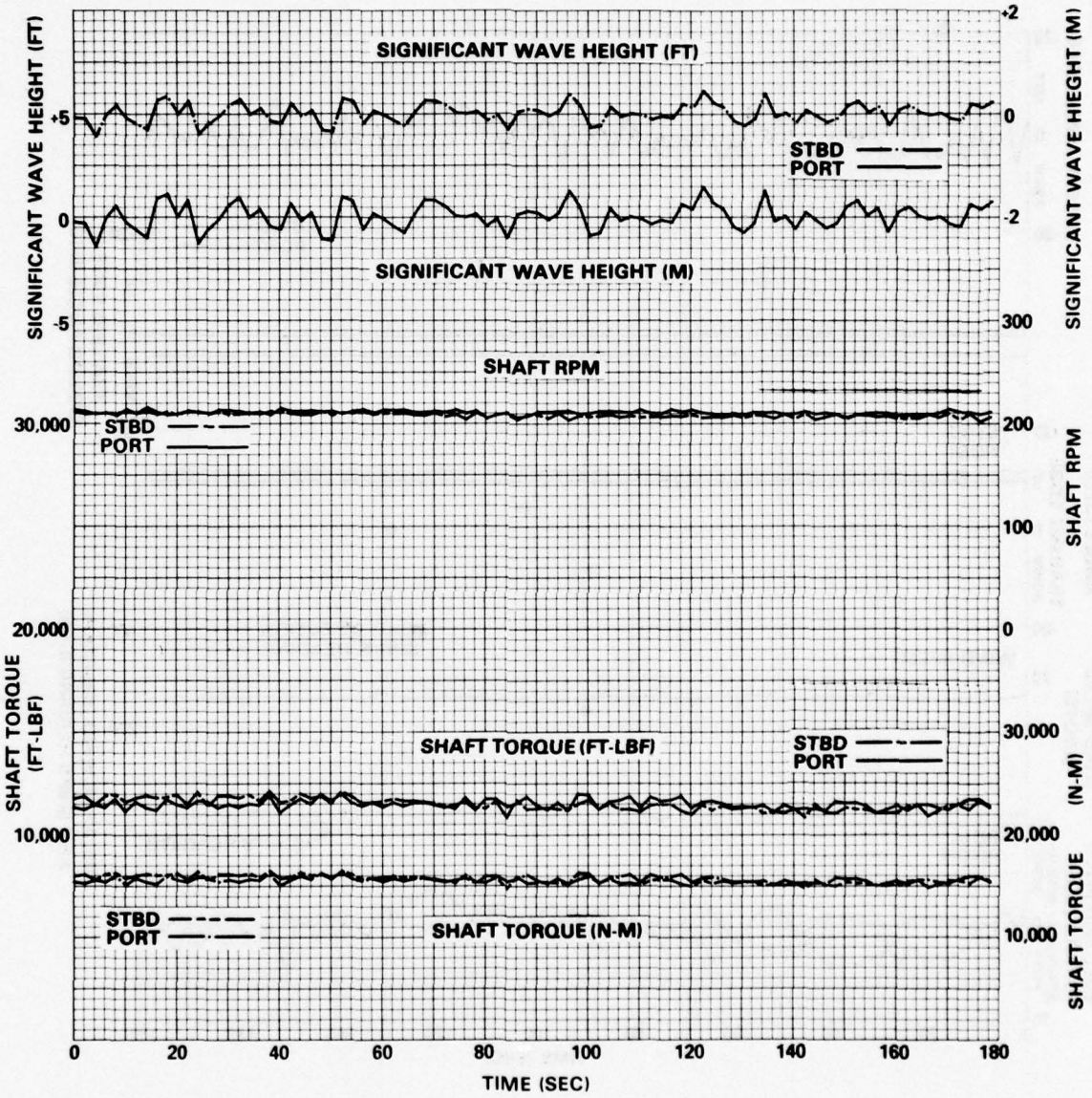

Figure 28b - Time History of Run 1140: Rough Water, Head Seas,
Displacement = 215.0 tons (218.4 metric tons),
Statically Trimmed by the Stern, Fixed Control Surfaces,
Ship Speed = 11.37 knots

Figure 29 - Time History of Run 1150

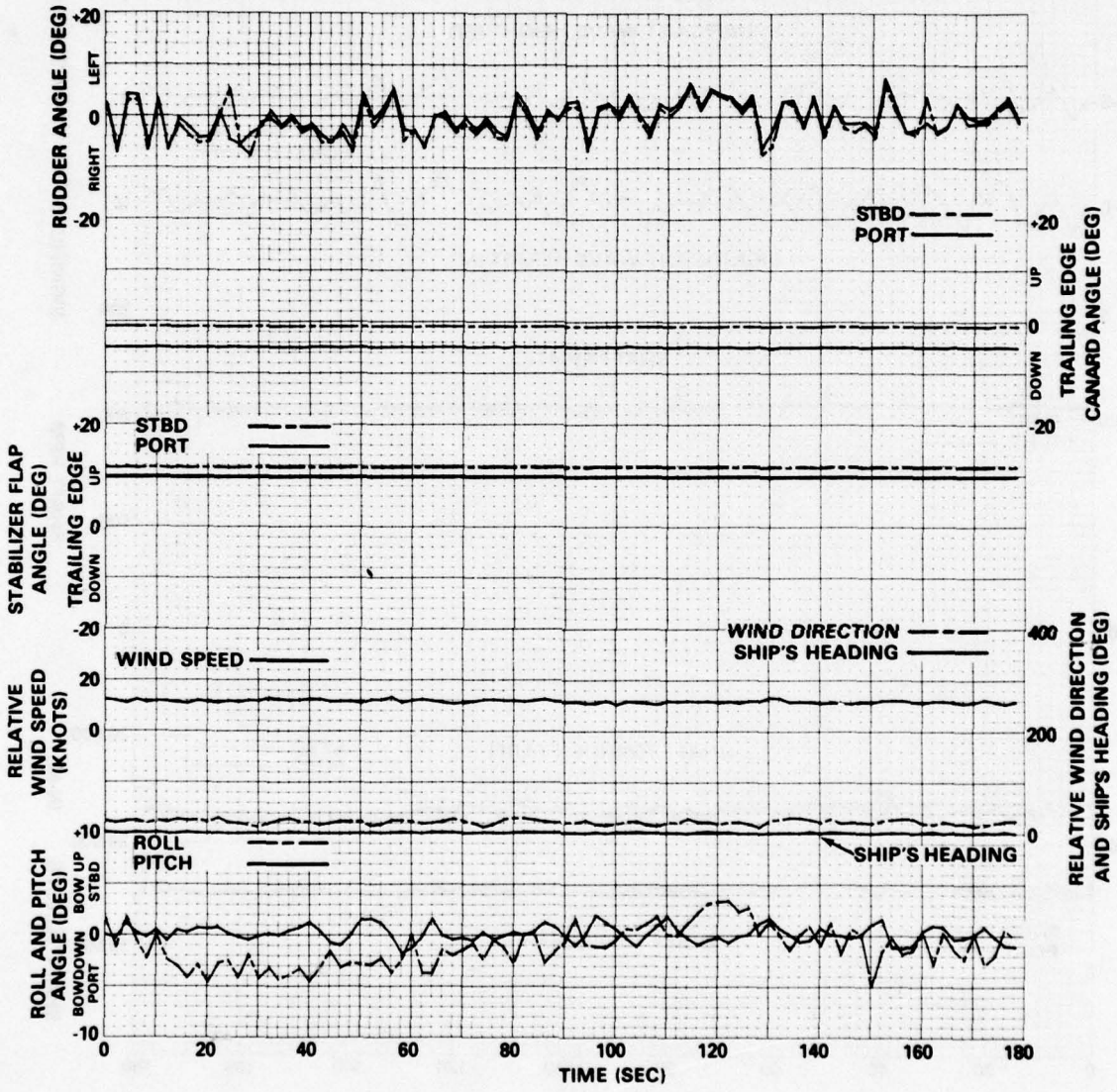

Figure 29a - Time History of Run 1150: Rough Water, Starboard Beam Seas, Displacement = 215.0 tons (218.4 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 12.37 knots

Figure 29 (Continued)

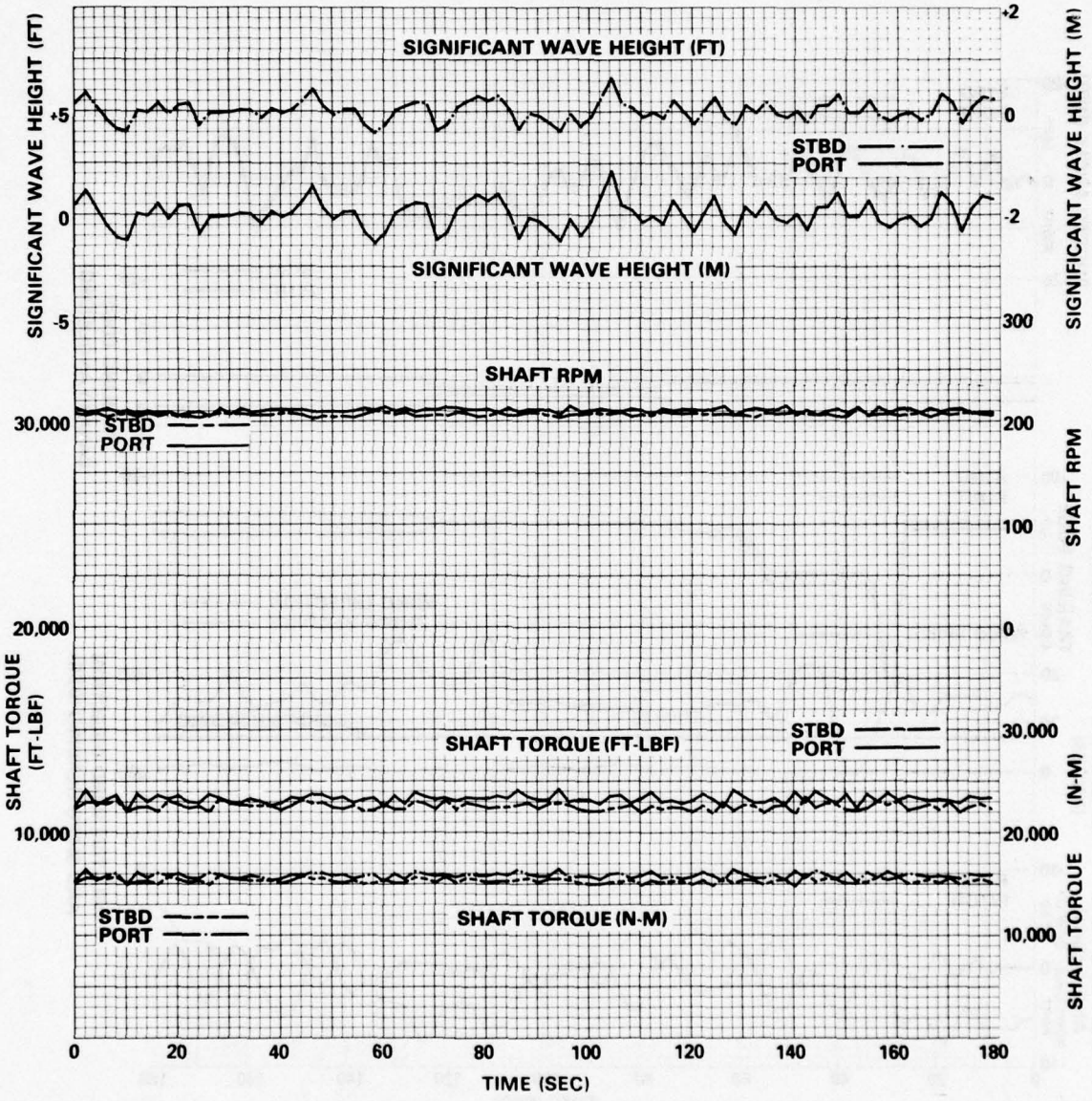

Figure 29b - Time History of Run 1150: Rough Water, Starboard Beam Seas, Displacement = 215.0 tons (218.4 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 12.37 knots

Figure 30 - Time History of Run 1160

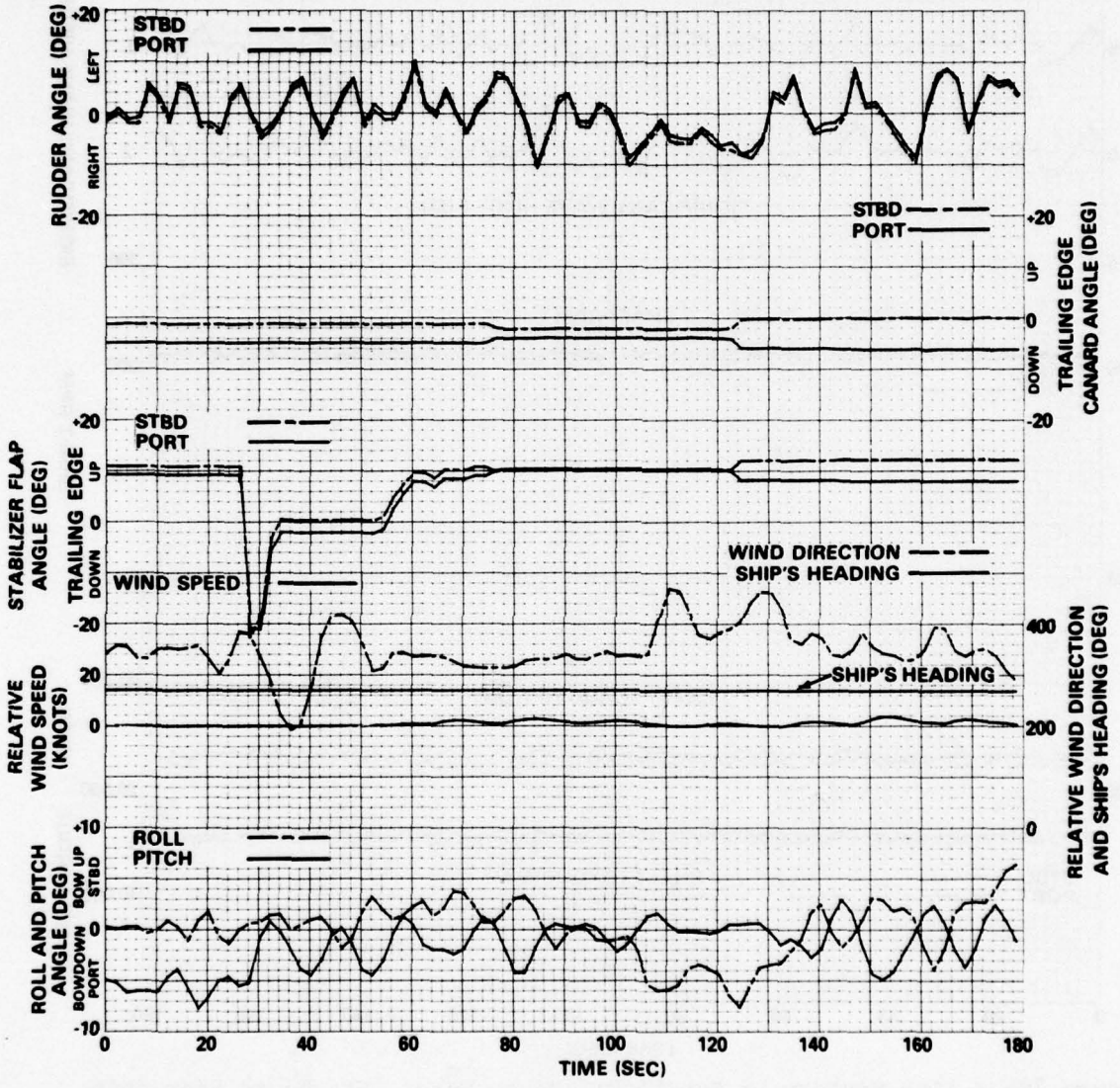

Figure 30a - Time History of Run 1160: Rough Water, Following Seas, Displacement = 215.0 tons (218.4 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 12.01 knots

Figure 30 (Continued)

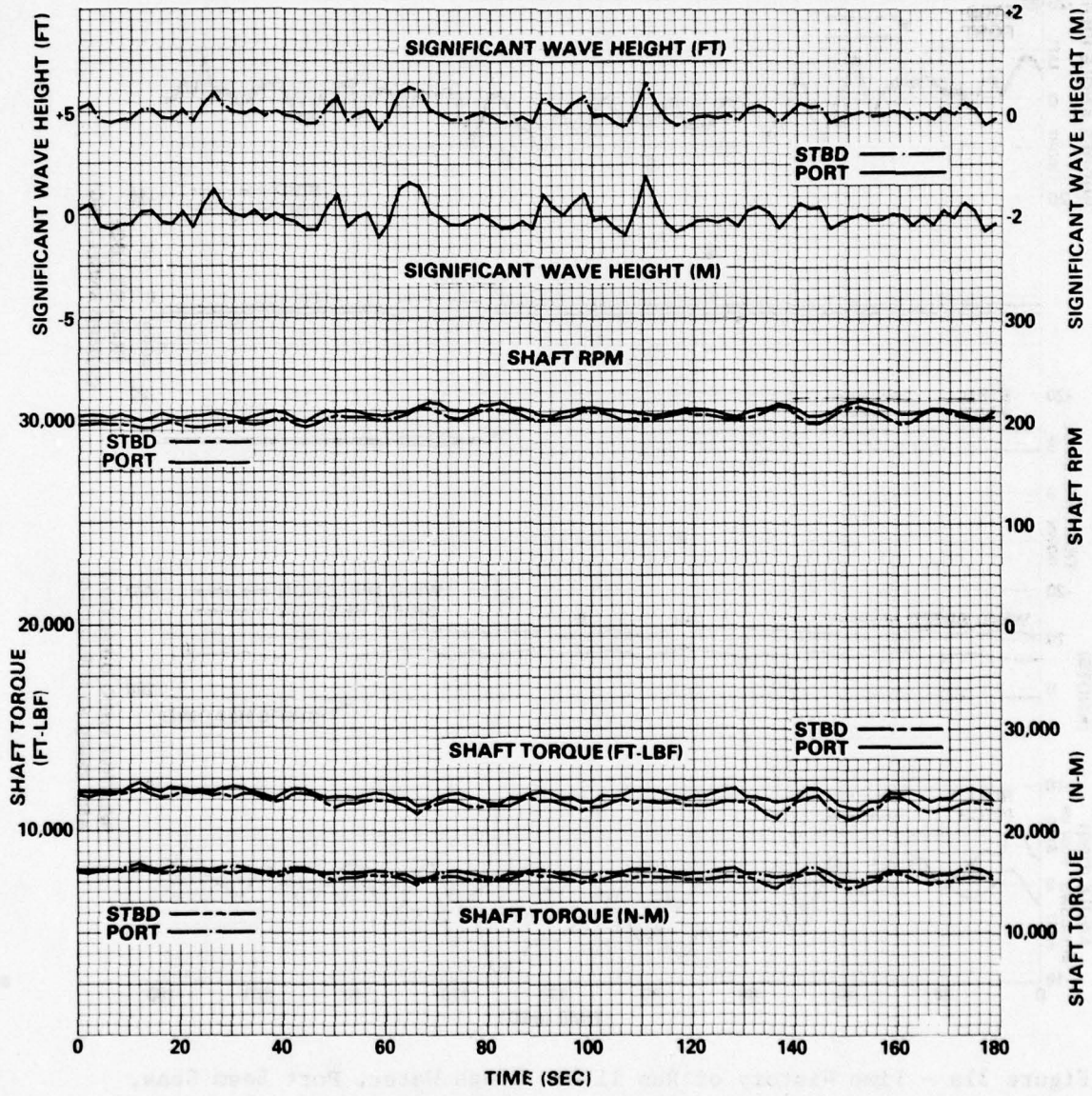

Figure 30b - Time History of Run 1160: Rough Water, Following Seas, Displacement = 215.0 tons (218.4 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 12.01 knots

Figure 31 - Time History of Run 1170

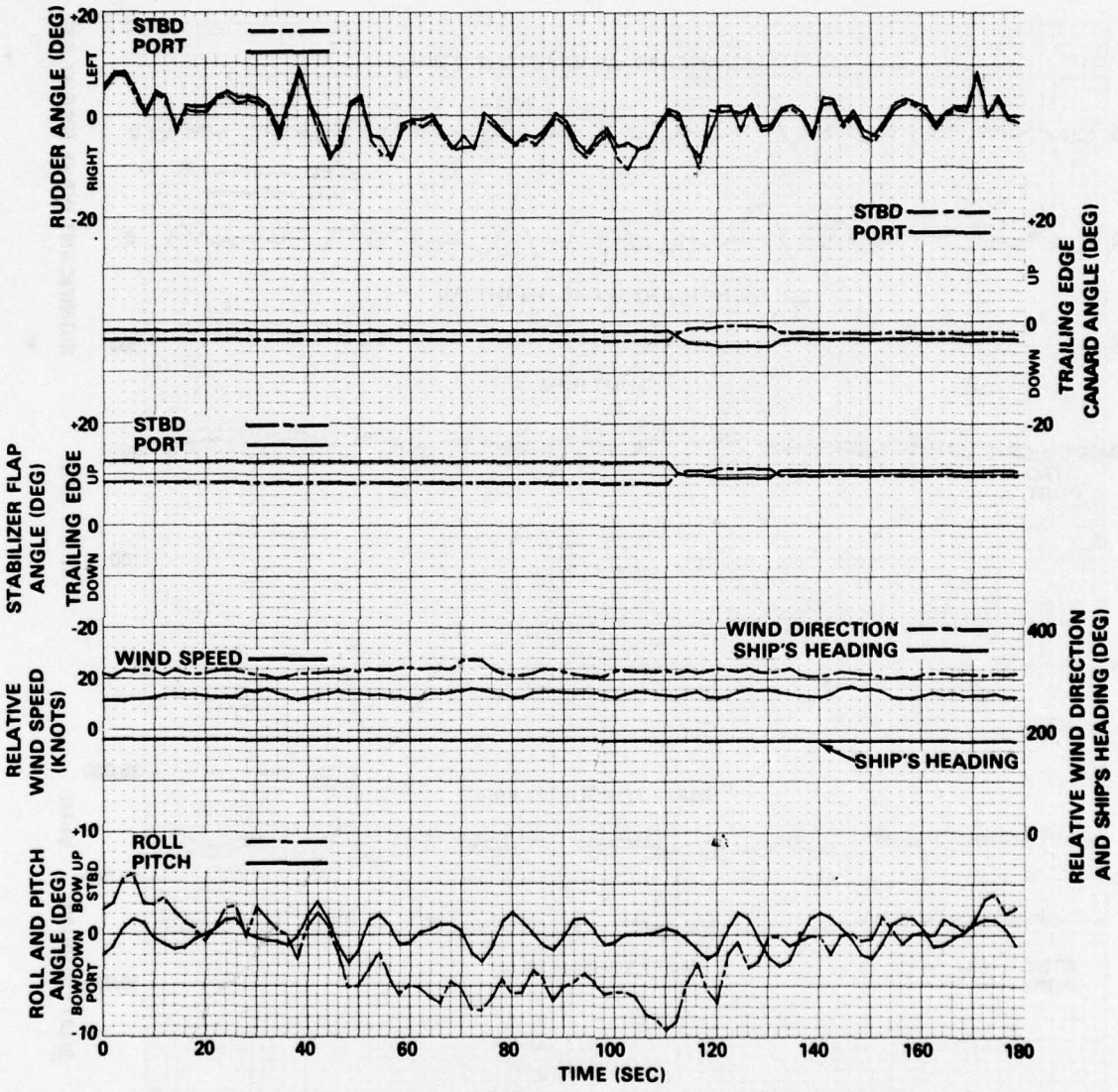

Figure 31a - Time History of Run 1170: Rough Water, Port Beam Seas, Displacement = 215.0 tons (218.4 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 11.23 knots

Figure 31 (Continued)

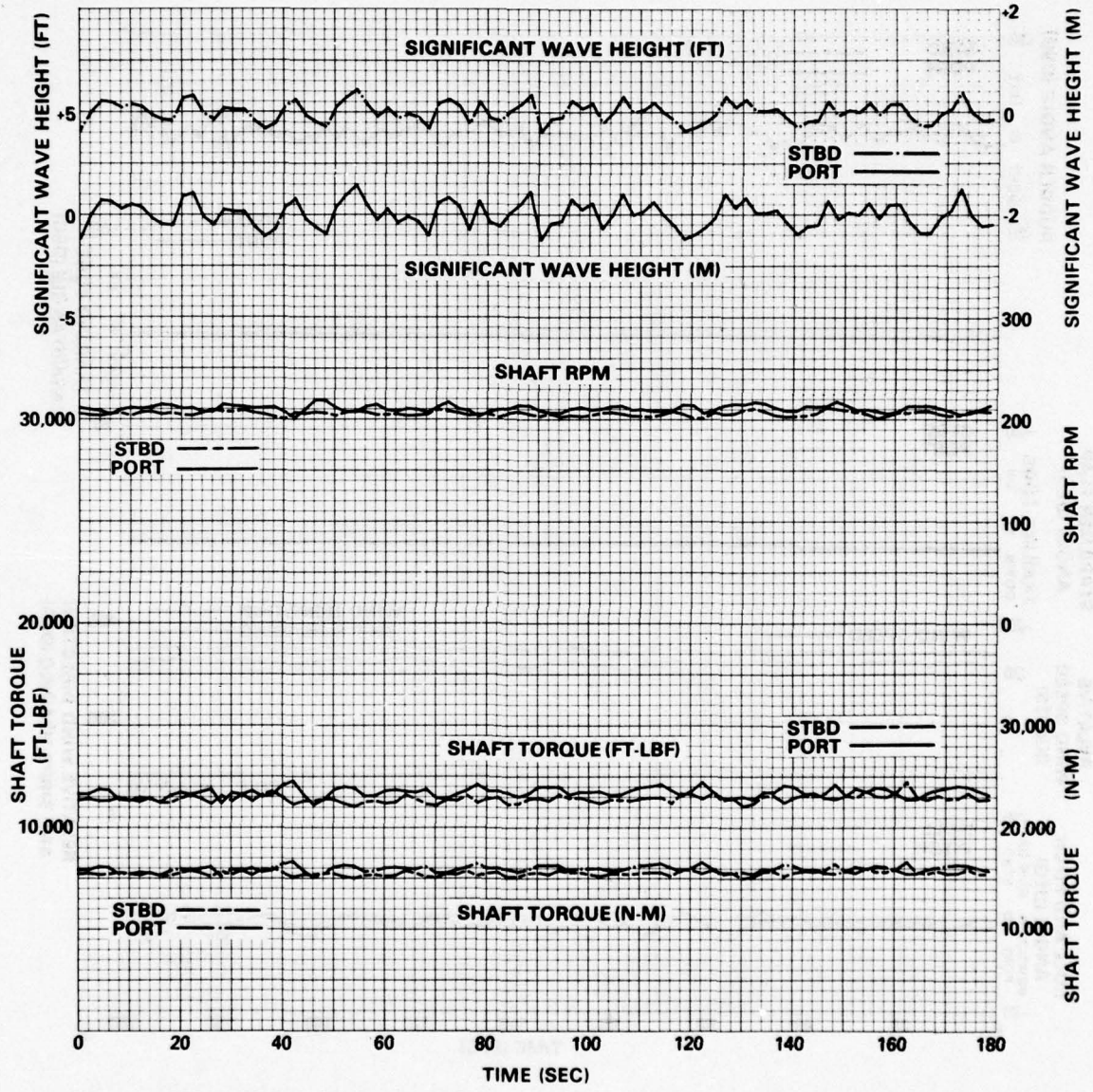

Figure 31b - Time History of Run 1170: Rough Water, Port Beam Seas, Displacement = 215.0 tons (218.4 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 11.23 knots

Figure 32 - Time History of Run 1260

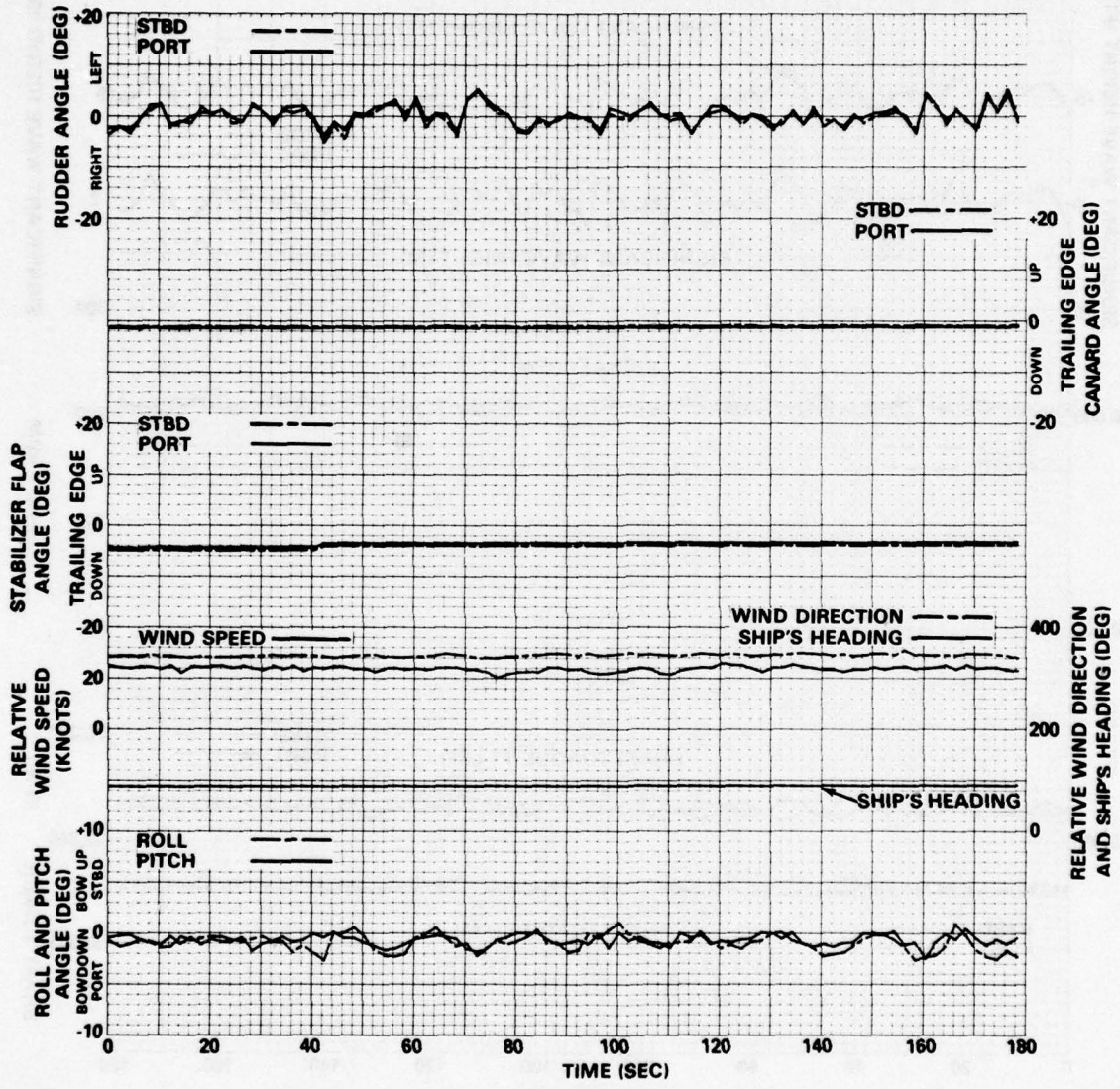

Figure 32a - Time History of Run 1260: Rough Water, Head Seas, Displacement = 215.0 tons (218.4 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 17.05 knots

Figure 32 (Continued)

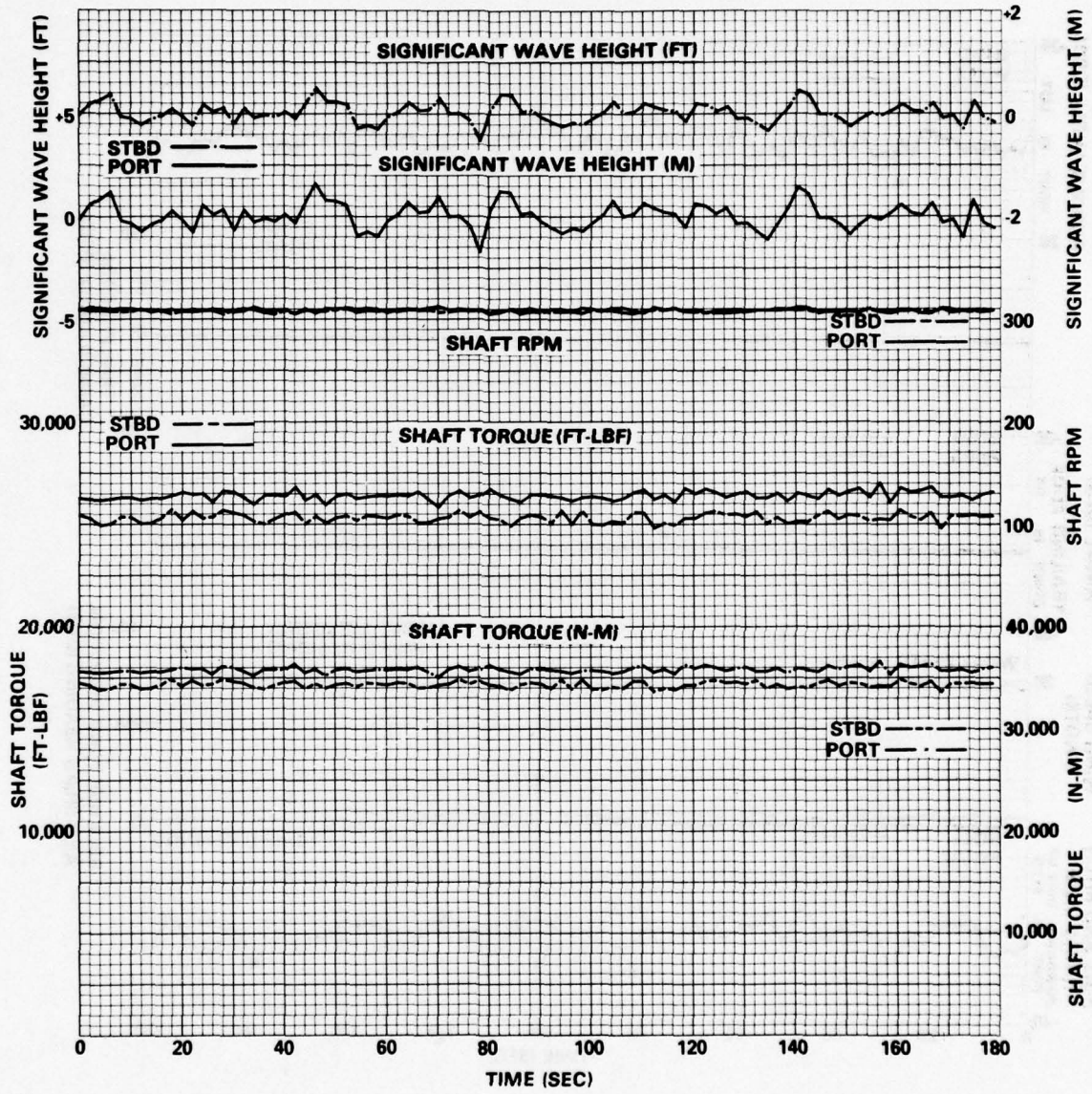

Figure 32b - Time History of Run 1260: Rough Water, Head Seas, Displacement = 215.0 tons (218.4 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 17.05 knots

Figure 33 - Time History of Run 1270

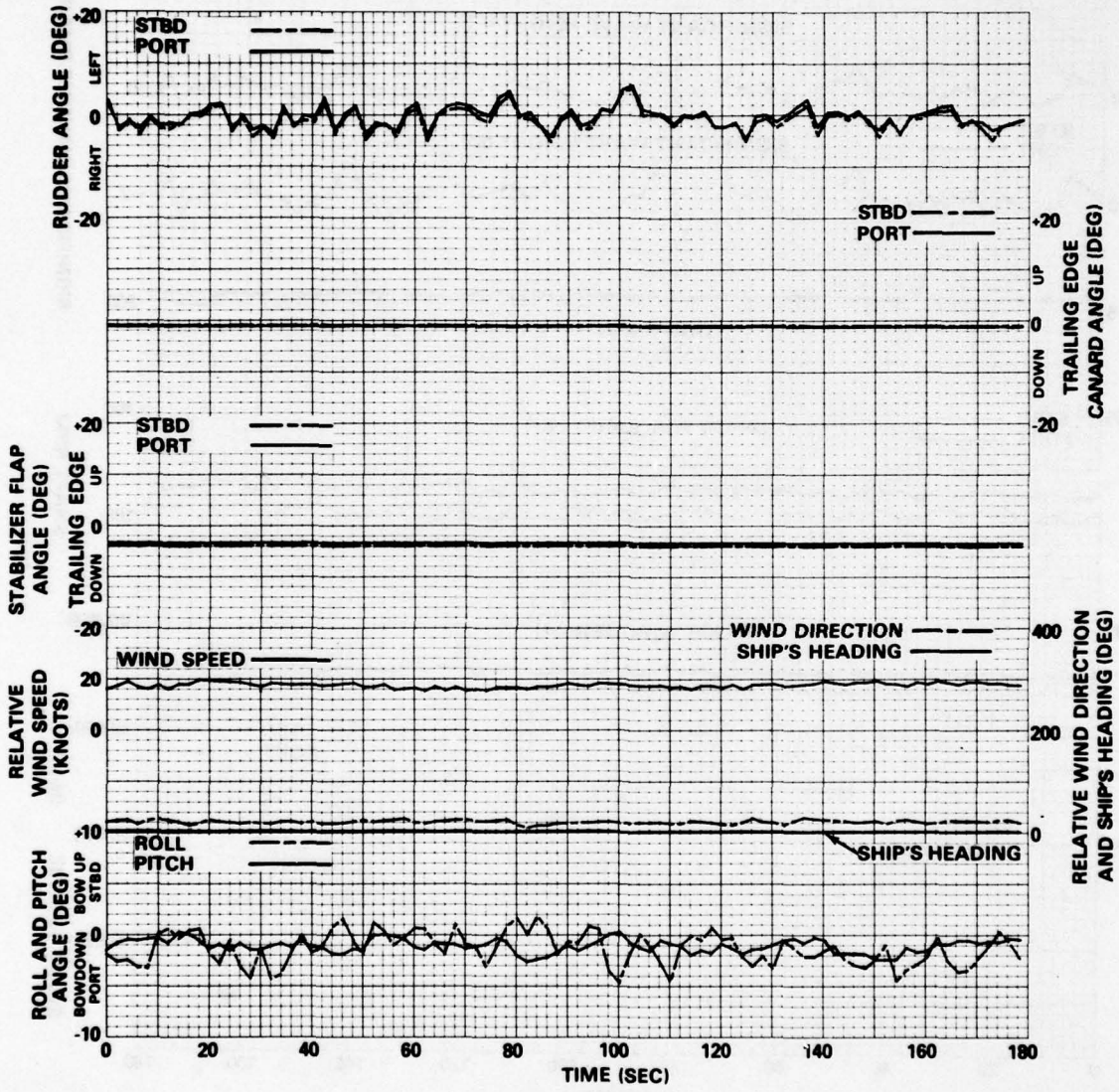

Figure 33a - Time History of Run 1270: Rough Water, Starboard Beam Seas, Displacement = 215.0 tons (218.4 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 18.03 knots

Figure 33 (Continued)

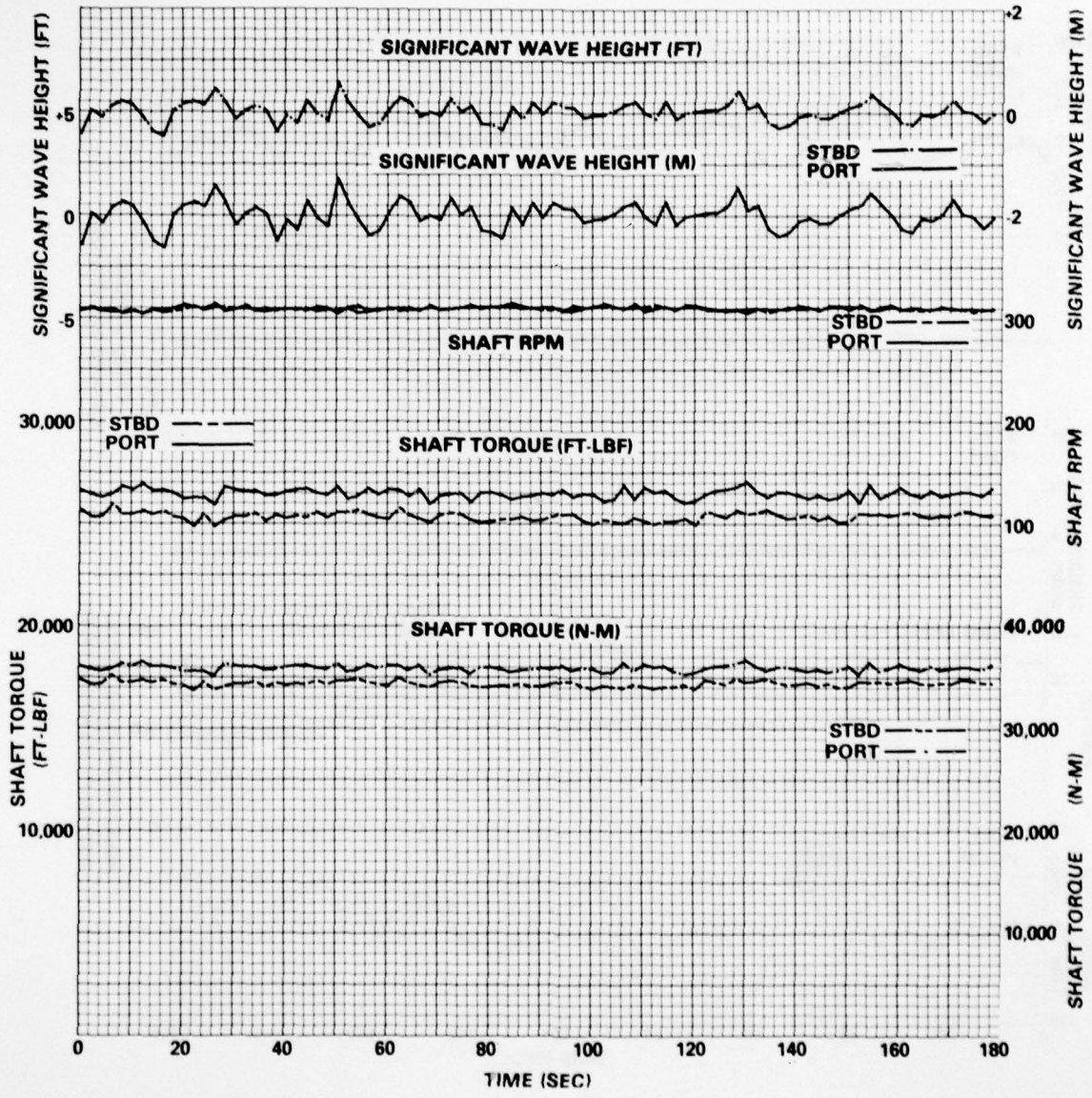

Figure 33b - Time History of Run 1270: Rough Water, Starboard Beam Seas, Displacement = 215.0 tons (218.4 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 18.03 knots

Figure 34 - Time History of Run 1280

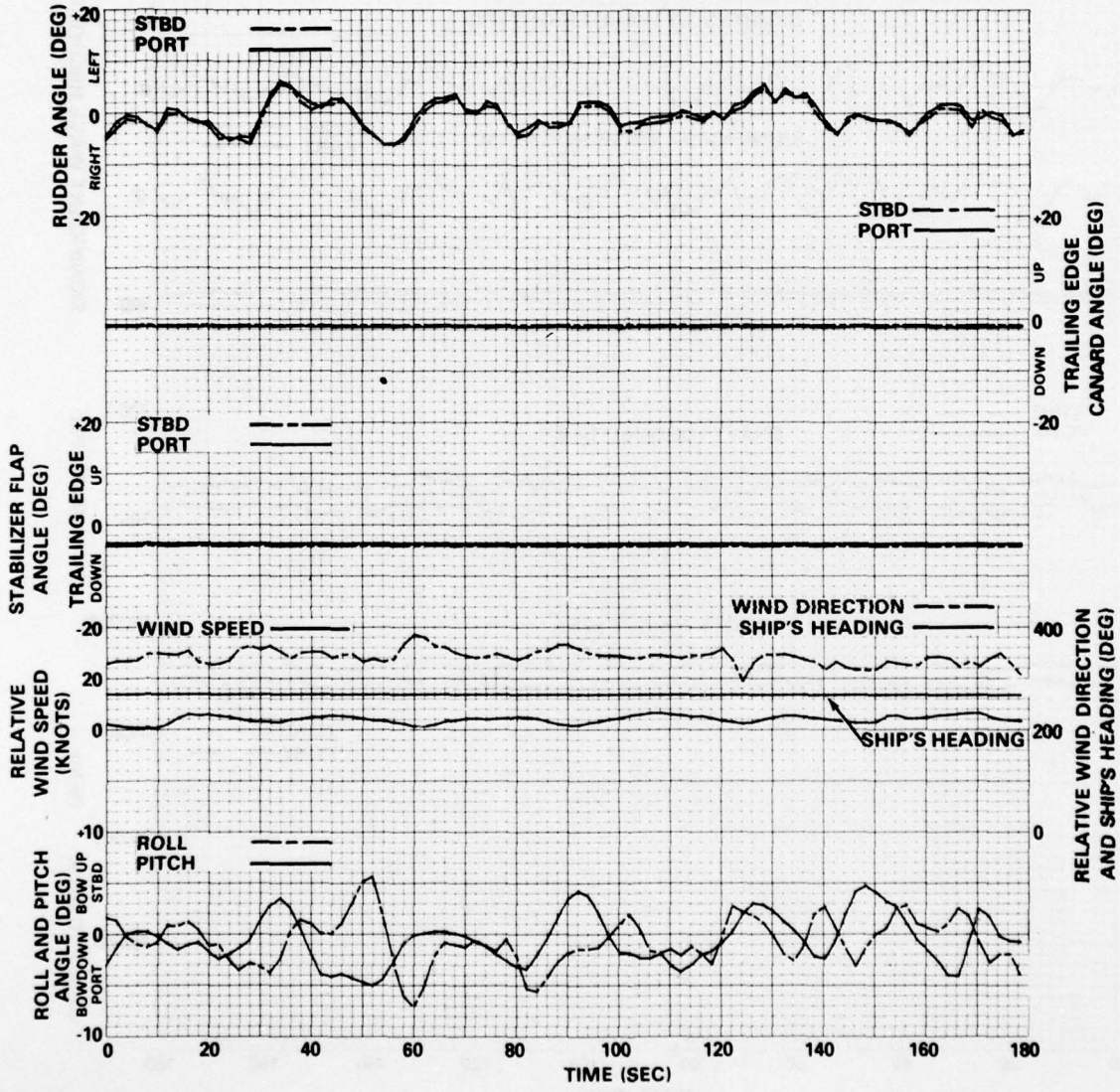

Figure 34a - Time History of Run 1280: Rough Water, Following Seas, Displacement = 215.0 tons (218.4 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 17.68 knots

Figure 34 (Continued)

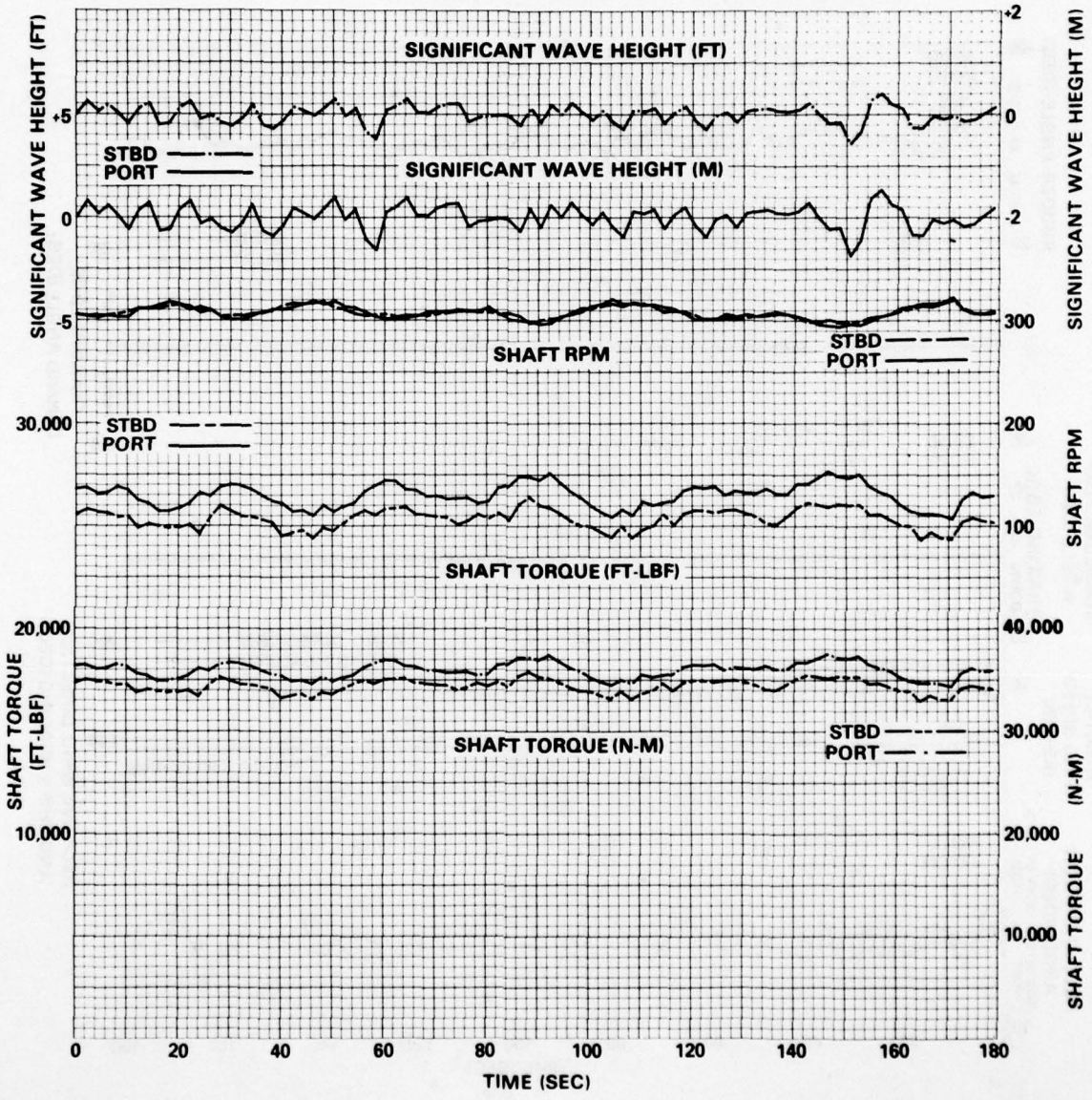

Figure 34b - Time History of Run 1280: Rough Water, Following Seas, Displacement = 215.0 tons (218.4 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 17.68 knots

Figure 35 - Time History of Run 1290

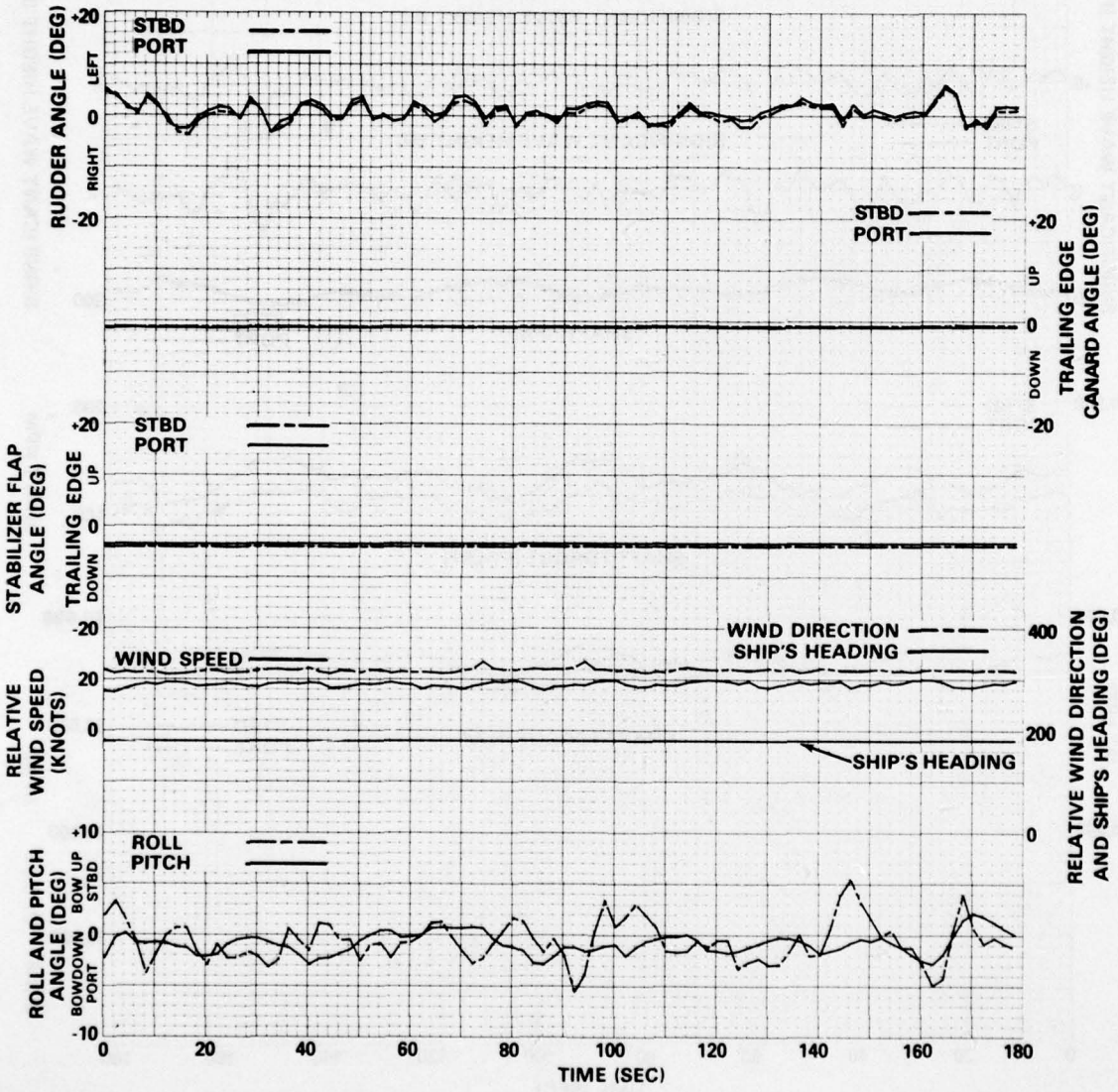

Figure 35a - Time History of Run 1290: Rough Water, Port Beam Seas, Displacement = 215.0 tons (218.4 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 17.02 knots

Figure 35 (Continued)

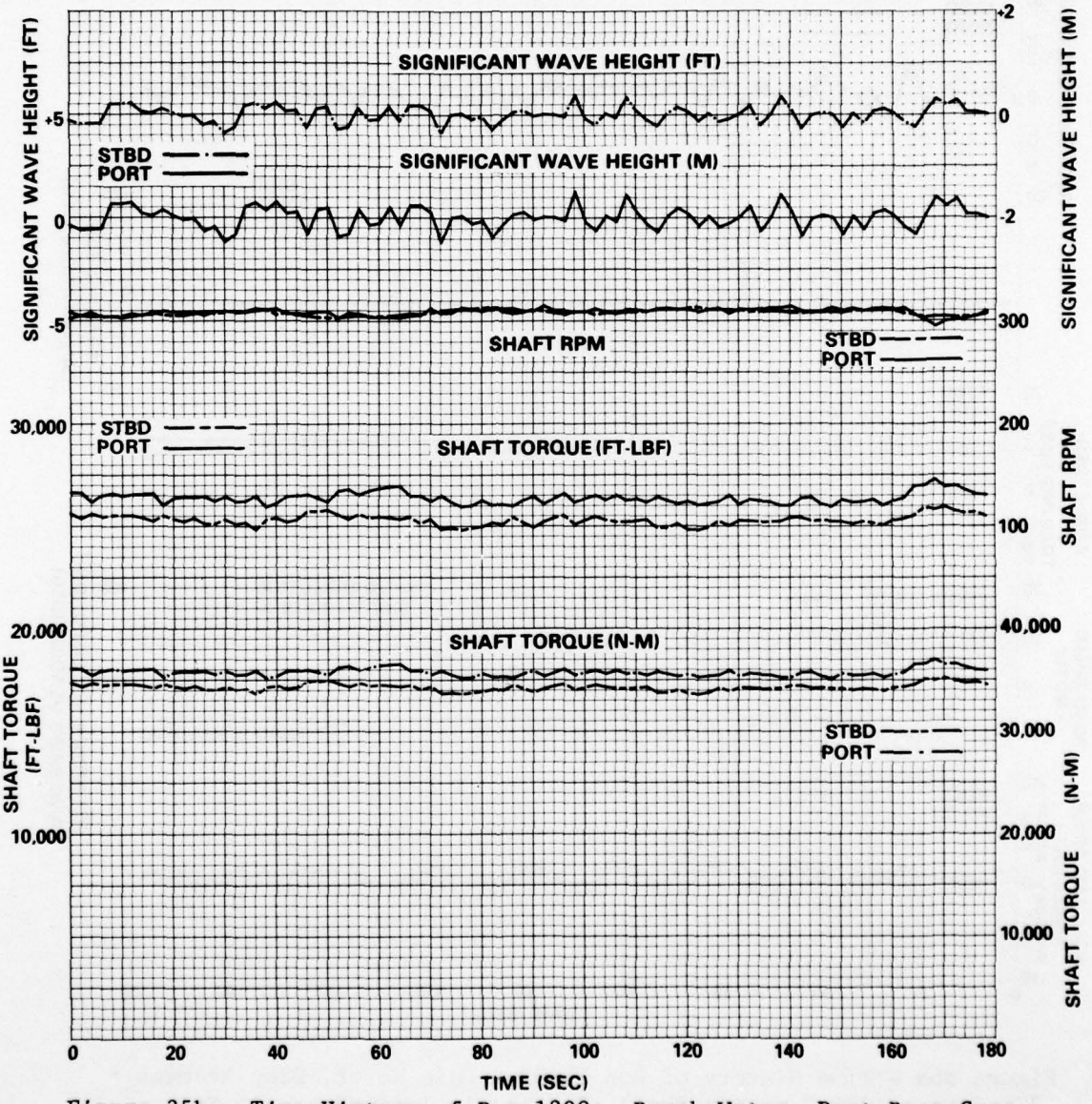

Figure 35b - Time History of Run 1290: Rough Water, Port Beam Seas, Displacement = 215.0 tons (218.4 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 17.02 knots

Figure 36 - Time History of Run 1360S

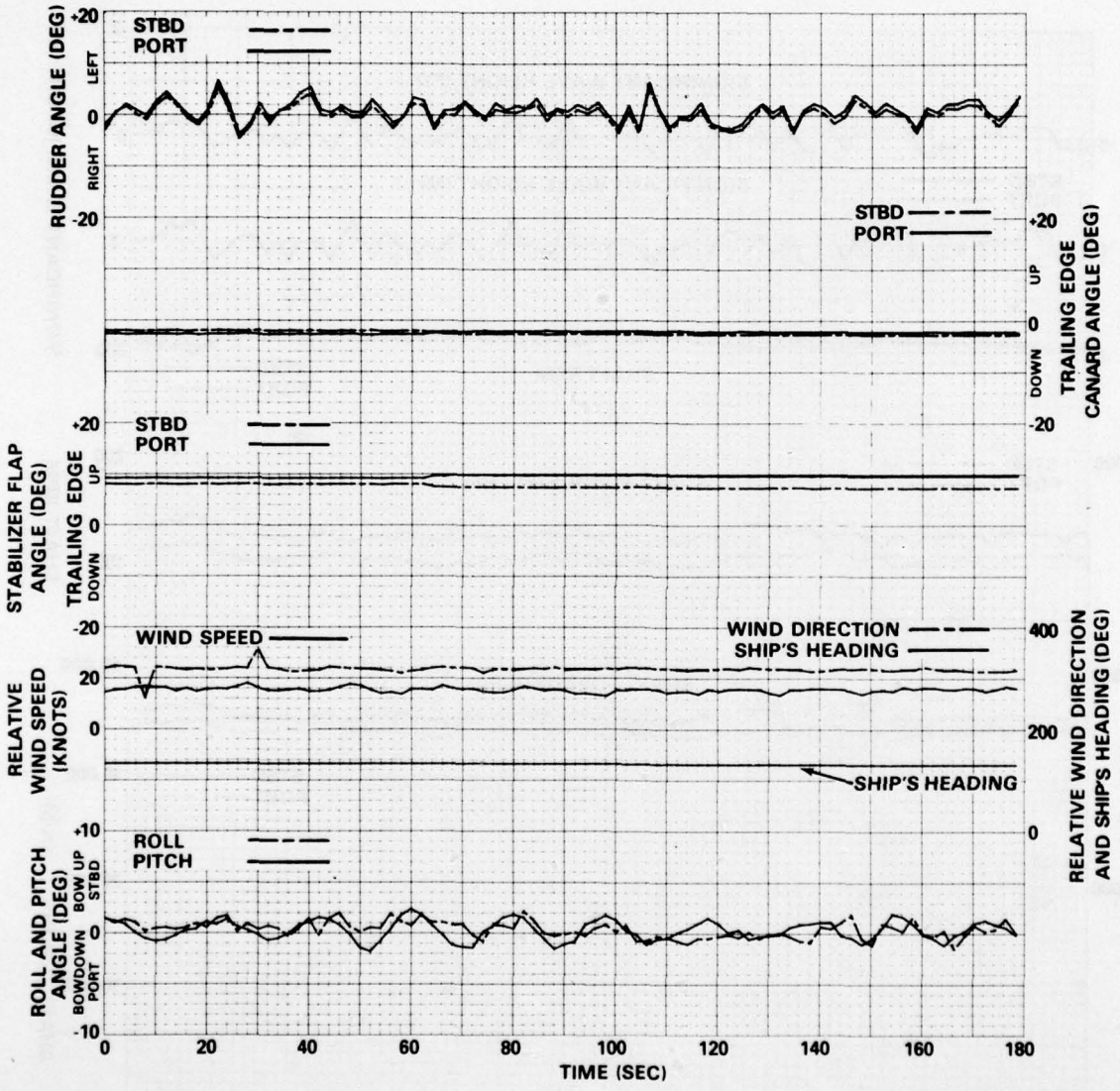

Figure 36a - Time History of Run 1360S: Calm Water, Displacement = 226.7 tons (230.3 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 13.39 knots

Figure 36 (Continued)

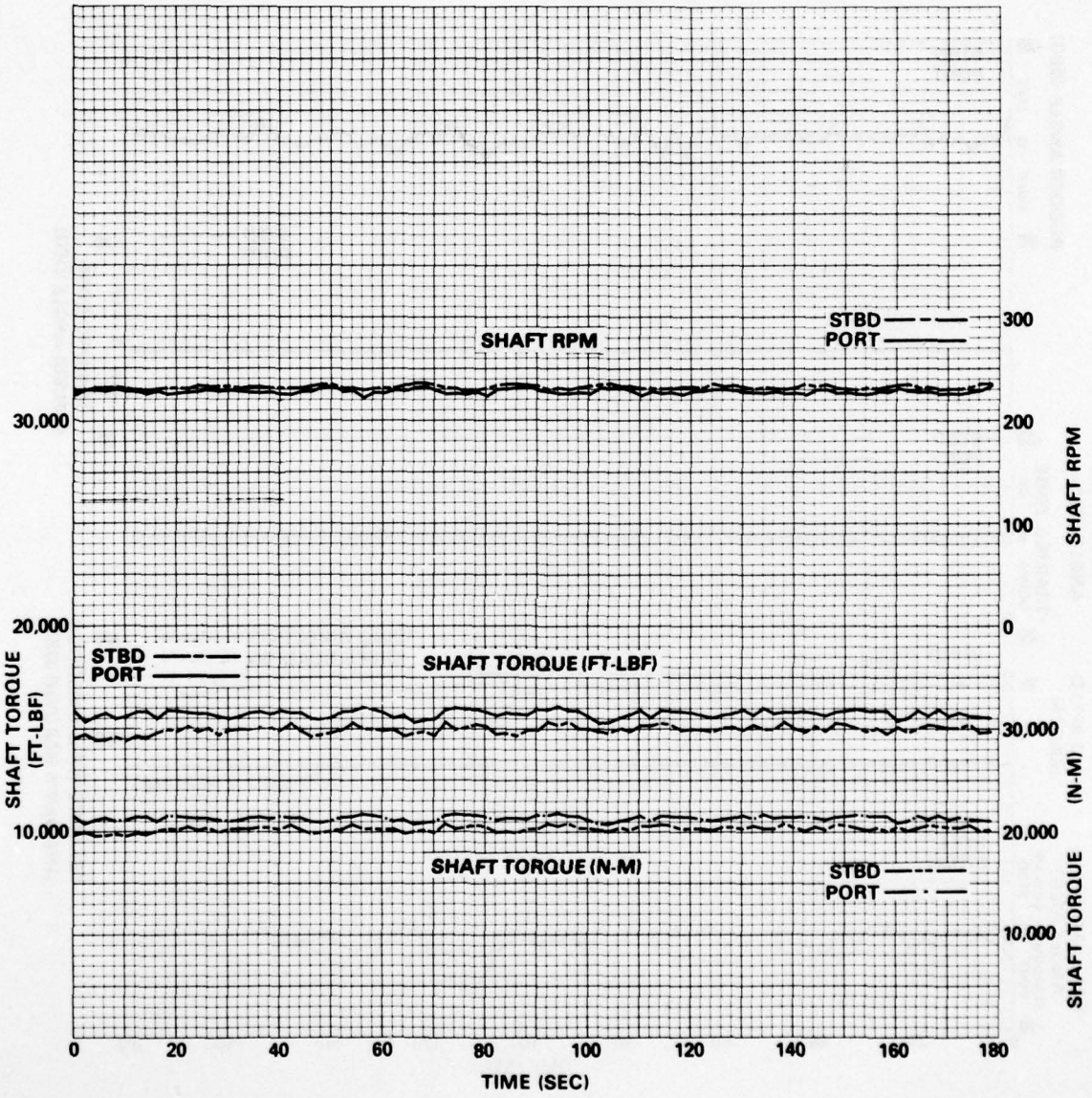

Figure 36b - Time History of Run 1360S: Calm Water, Displacement = 226.7 tons (230.3 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 13.39 knots

Figure 37 - Time History of Run 1420S

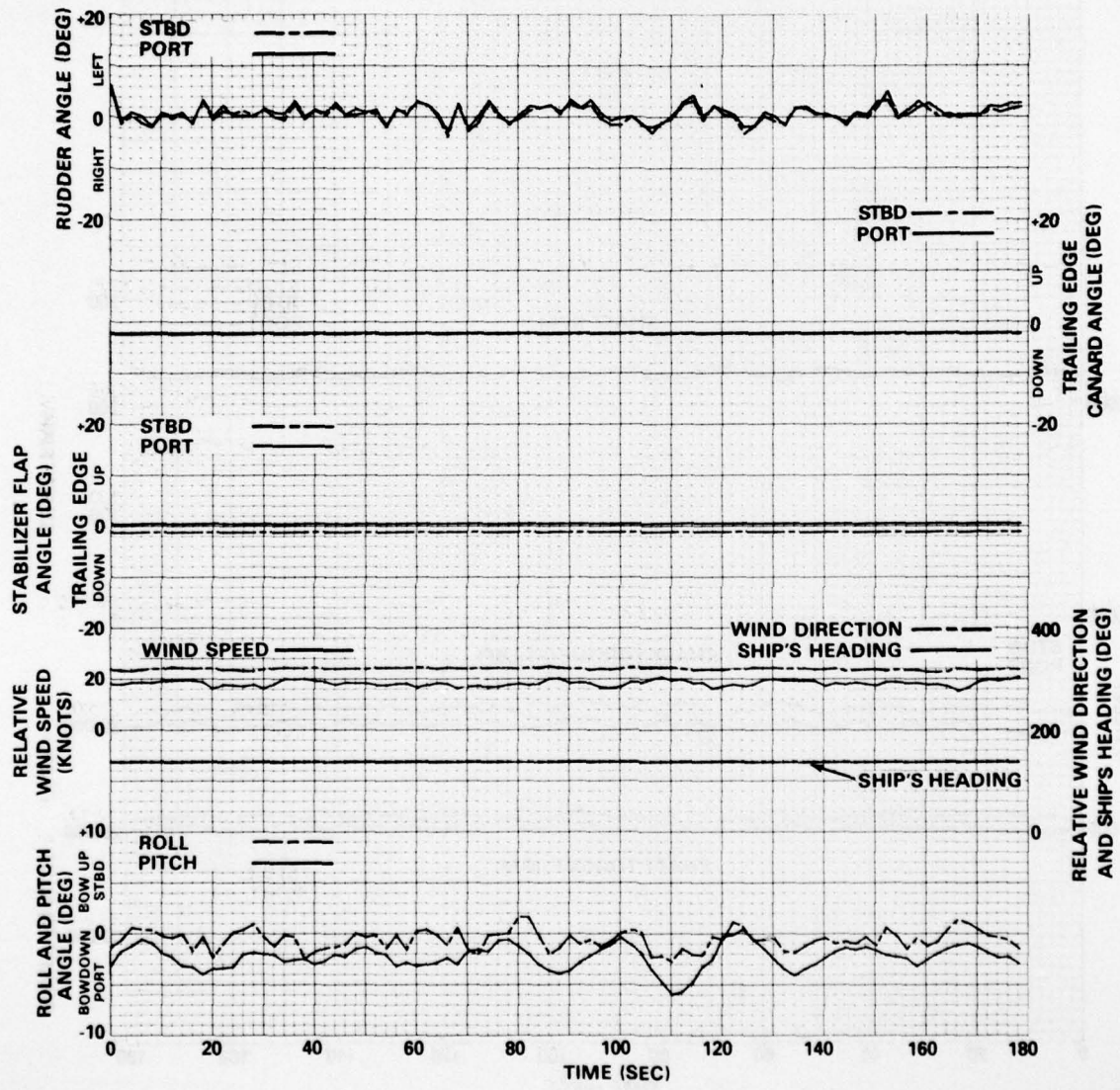

Figure 37a - Time History of Run 1420S: Calm Water, Displacement = 226.7 tons (230.3 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 18.89 knots

Figure 37 (Continued)

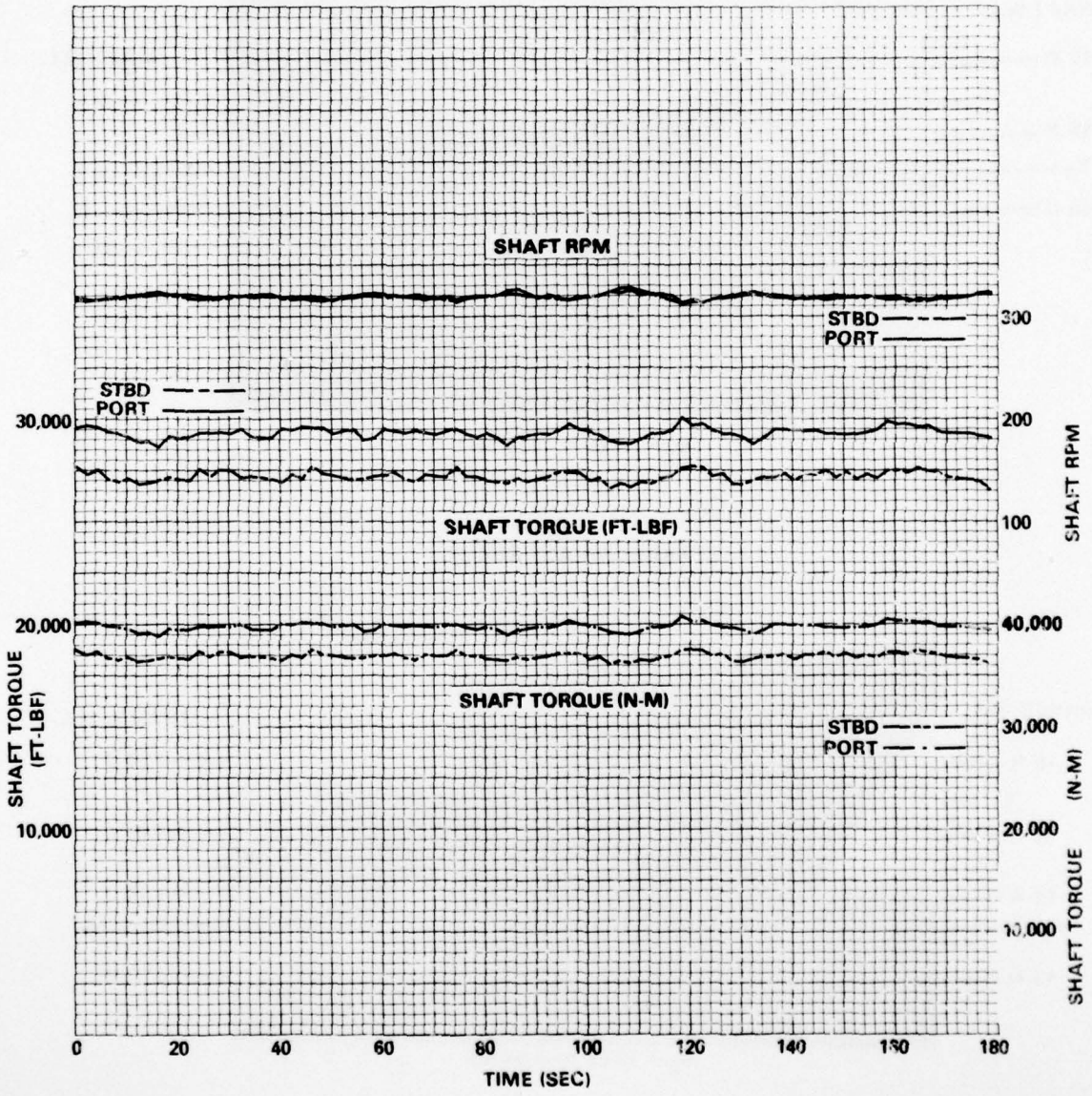

Figure 37b - Time History of Run 1420S: Calm Water, Displacement = 226.7 tons (230.3 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces, Ship Speed = 18.89 knots

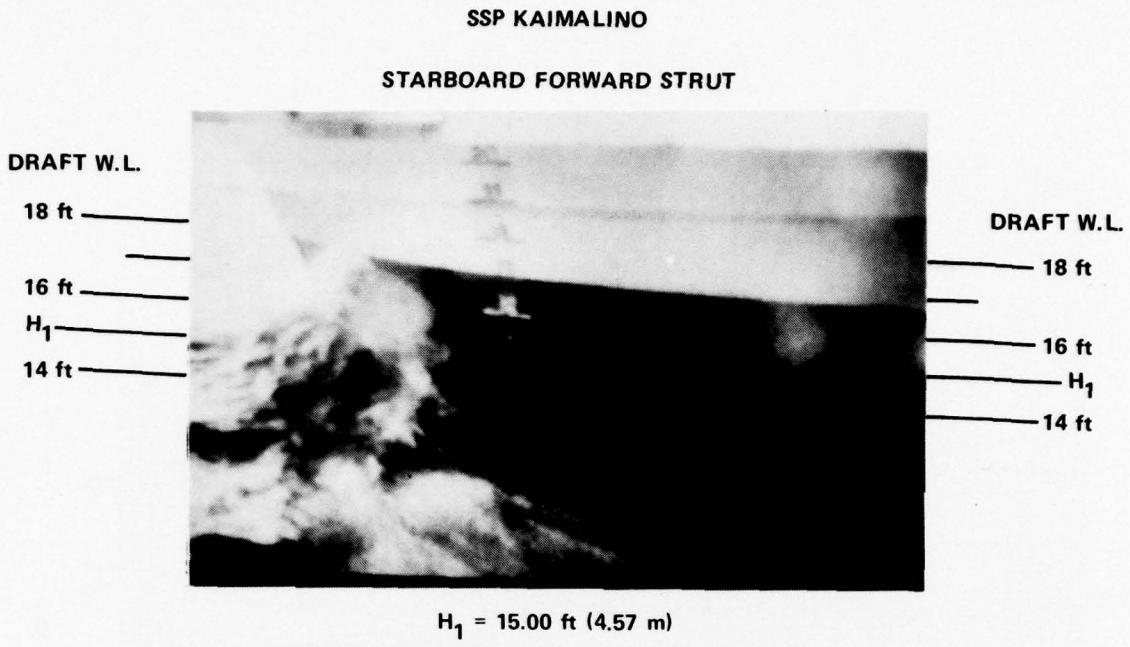

Figure 38 - A Typical Video Tape View of the Starboard Struts During a Trial Run

TABLE 1 - PRINCIPAL SHIP AND PROPELLER CHARACTERISTICS

SHIP DIMENSIONS

Length Overall, ft (m)	88.33 (26.92)
Maximum Beam, ft (m)	49.66 (15.14)
Displacement, ton (metric ton)	237.80 (241.60)
Draft, ft (m)	16.97 (5.17)
Overall Height, ft (m)	31.75 (9.68)
Deck Width, ft (m)	45.00 (13.72)
Lower Hull Diameter, ft (m)	6.50 (1.98)
Height, Waterline to Deck, ft (m)	12.78 (3.90)
Deck Well, ft (m)	23.0 x 12.5 (7.01 x 3.81)
Distance between Lower Hull Centerlines, ft (m)	40.00 (12.19)

CANARDS (each)

Section Profile, NACA	64-015
Span, ft (m)	6.00 (1.83)
Longitudinal Distance from CG to Hinge Axis, ft (m)	28.30 (8.63)
Longitudinal Distance from Trailing Edge to Hinge Axis, ft (m)	4.90 (1.49)
Vertical Distance from Baseline to Hinge Axis, ft (m)	3.25 (0.99)
Maximum Chord, ft (m)	7.50 (2.29)
Minimum Chord, ft (m)	4.00 (1.22)
Thickness, ft (m)	0.86 (0.26)

STERN FOIL

Chord, ft (m)	7.80 (2.38)
Section Profile, Modified NACA (wedge-shaped trailing edge)	64-021
Span at Leading Edge, ft (m)	34.60 (10.55)
Longitudinal Distance from CG to 25 Percent Chord, ft (m)	30.00 (9.14)

TABLE 1 (Continued)

Chord, Each Flap, ft (m)	1.95 (0.59)
Span, Flaps, Total, ft (m)	34.60 (10.55)
Thickness, ft (m)	1.64 (0.50)
Height from Baseline to Chord Line, ft (m)	3.25 (0.99)

RUDDERS (each)

Chord, Trailing Edge to Hinge Axis, ft (m)	2.88 (0.88)
Span, ft (m)	9.25 (2.82)
Transverse Distance from Centerline to Hinge Axis, ft (m)	20.00 (6.10

PROPELLER CHARACTERISTICS

Wilkinson Controllable Pitch Propellers	2
Diameter, ft (m)	6.50 (1.98)
Pitch Diameter Ratio	Variable
Number of Blades, each	4
Direction of Rotation	Right-Hand

TABLE 2 - SUMMARY OF TRIAL RUNS

Date	Type of Run	Location	Number of Runs
19 September 1979	Calm Water, Heavy Displacement = 237.1 tons (240.9 metric tons), Statically 0° Trim, Fixed Control Surfaces	FORACS Range Lualualei, HI	14
20 September 1979	Calm Water, Heavy Displacement = 237.8 tons (241.6 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces	FORACS Range Lualualei, HI	14
21 September 1979	Calm Water, Light Displacement = 217.4 tons (220.9 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces	FORACS Range Lualualei, HI	23
25 September 1979	Calm Water, Heavy Displacement = 237.8 tons (241.6 metric tons), Statically 0° Trim, Automatic Control System	FORACS Range Lualualei, HI	16
27 September 1979	Rough Water, Medium Displacement = 228.4 tons (232.1 metric tons), Statically Trimmed by the Stern, Automatic Control System	Kaneohe Bay, HI	31
28 September 1979	Rough Water, Light Displacement = 215.0 tons (218.4 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces	Kaneohe Bay, HI	24
02 October 1979	Calm Water, Medium Displacement = 226.7 tons (230.3 metric tons), Statically Trimmed by the Stern, Fixed Control Surfaces	Kaneohe Bay, HI	19
		Total No. of Runs	141

TABLE 3 - SUMMARY OF TRIAL CONDITIONS

Displacement (ton)	Displacement (metric ton)	Average True Wind Direction (deg)	Average True Wind Velocity (knot)	Static Trim by the Stern (ft)	Static Trim by the Stern (m)	Water Temperature (deg F)	Water Temperature (deg C)	Air Temperature (deg F)	Air Temperature (deg C)	Water Specific Gravity	State Sea
19 September 1979											
237.1	240.9	262	9	0.0	0.00	80	26.7	86	30.0	1.023	0-1
20 September 1979											
237.8	237.8	265	9	1.6	0.49	80	26.7	86	30.0	1.023	0-1
21 September 1979											
217.4	220.9	240	12	2.5	0.76	81	27.2	87	30.6	1.022	0-1
25 September 1979											
237.8	241.6	108	11	0.3	0.09	82	27.8	88	31.1	1.023	-
27 September 1979											
228.4	232.1	73	10	2.6	0.79	80	26.7	86	30.0	1.022	2
28 September 1979											
215.0	218.4	81	9	1.8	0.55	80	26.7	86	30.0	-	2
02 October 1979											
226.7	230.3	44	9	2.4	0.73	80	26.7	85	29.4	-	1

AD-A083 261 DAVID W TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CE--ETC F/G 13/10
STANDARDIZATION TRIALS OF THE STABLE SEMISUBMERGED PLATFORM, SS--ETC(U)
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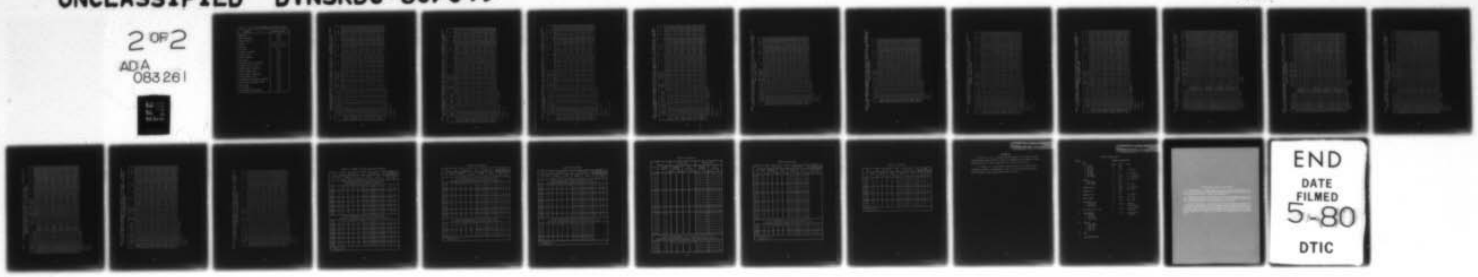

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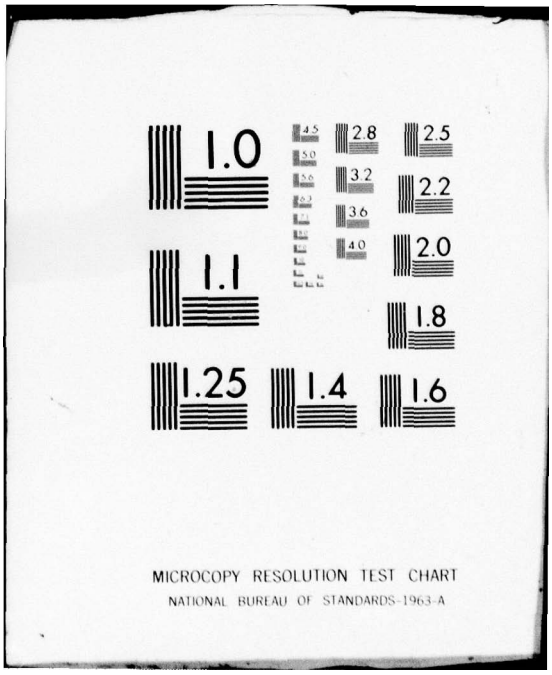
1.0
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4.0
4.5
5.0
5.6
6.3
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

TABLE 4 - LIST OF DATA CHANNELS AND ACCURACY LEVELS

Channel	Accuracy Level
Heading	± 2%
Wind Direction	± 2%
Wind Velocity	± 2%
Range A	± 10 ft (± 3 m)
Range B	± 10 ft (± 3 m)
Run Time	N.A.
Torque, Starboard	± 5%
Torque, Port	± 5%
RPM, Starboard	± 1%
RPM, Port	± 1%
Propeller Pitch, Starboard	N.A.
Propeller Pitch, Port	N.A.
Rudder Angle, Starboard	± 2%
Rudder Angle, Port	± 2%
Canard Angle, Starboard	± 2%
Canard Angle, Port	± 2%
Stabilizer Flap Angle, Starboard	± 2%
Stabilizer Flap Angle, Port	± 2%
Roll Angle	± 1%
Pitch Angle	± 1%
Wave Height (Sonic Buoy)	± 2%

TABLE 5 - SSP KAIMALINO STANDARDIZATION TRIAL RESULTS, ENGLISH UNITS: 19 SEPTEMBER 1979, CALM WATER, HEAVY DISPLACEMENT = 237.1 TONS, STATICALLY 0 DEGREE TRIM, FIXED CONTROL SURFACES

Run	Mini-ranger Speed (knots)	Doppler Log Speed (knots)	Average Pitch* (deg)	Average Roll* (deg)	Average Canard Angles* (deg)		Average Stabilizer Flap Angles* (deg)		Shaft RPM			Shaft Torque (ft-lbf)			Shaft Horsepower		
					Stbd	Port	Stbd	Port	Stbd	Port	Average	Stbd	Port	Total	Stbd	Port	Total
011S	4.87	-	-0.3	0.2	-6.8	7.2	5.0	21.7	86.9	64.7	75.8	2,250	800	3,050	35	10	45
020N	4.49	-	-0.9	0.9	-6.7	7.2	5.1	21.7	87.3	66.3	76.8	2,360	940	3,300	40	10	50
	4.68	-									76.3			3,180			50
040S	8.46	-	0	0.2	-2.4	4.5	3.9	8.2	150.4	156.3	153.4	6,470	7,810	14,280	185	235	420
050N	7.55	-	-0.5	0.8	-2.3	6.6	4.0	8.2	149.3	155.5	152.4	6,510	7,890	14,400	185	235	420
060S	8.37	-	1.3	0.3	-2.4	0.1	4.0	8.2	151.6	156.5	154.1	6,620	7,870	14,490	190	235	425
	7.98	-									153.0			14,390			420
070N	9.65	-	-0.5	0.9	-1.6	-0.7	-2.1	0	214.8	210.9	212.9	15,530	15,820	31,350	635	635	1270
080S	9.92	-	0	0.4	-1.6	-0.7	-2.1	-8.1	216.2	212.2	214.2	15,660	15,980	31,640	645	645	1290
	9.79	-									213.5			31,500			1280
100N	12.99	-	0.7	1.0	-1.5	-0.6	4.8	7.4	241.5	237.7	239.6	17,060	18,250	35,310	785	825	1610
110S	13.34	-	0.7	0.5	-1.1	-1.0	8.7	10.7	243.9	239.1	241.5	17,350	18,240	35,590	805	830	1635
	13.17	-									240.6			35,450			1625
130N	14.90	-	-0.7	1.5	-5.9	-7.1	3.6	4.1	277.6	274.6	276.1	22,220	23,140	45,360	1175	1210	2385
140S	15.10	-	-0.4	0.7	-5.9	-7.5	3.3	3.8	282.0	276.2	279.1	22,980	23,050	46,030	1235	1210	2445
	15.00	-									277.6			45,700			2415
190N	17.44	-	-0.7	0.9	-0.9	-1.9	-1.9	-1.6	314.5	311.5	313.0	27,720	28,960	56,680	1660	1720	3380
200S	17.58	-	-0.1	0.2	-0.7	-2.0	-1.7	-1.8	316.9	311.9	314.4	28,100	28,870	56,970	1695	1715	3410
	17.51	-									313.7			56,830			3395

* + Trailing Edge Up
  - Trailing Edge Down
  } Canard and Stabilizer Flap Angles

  + Bow Up
  - Bow Down
  } Pitch

  + Stbd Roll
  - Port Roll

TABLE 6 - SSP KAIMALINO STANDARDIZATION TRIAL RESULTS, METRIC UNITS: 19 SEPTEMBER 1979, CALM WATER, HEAVY DISPLACEMENT = 240.9 METRIC TONS, STATICALLY 0 DEGREE TRIM, FIXED CONTROL SURFACES

Run	Mini-ranger Speed (knots)	Doppler Log Speed (knots)	Average Pitch* (deg)	Average Roll* (deg)	Average Canard Angles* (deg)		Average Stabilizer Flap Angles* (deg)		Shaft RPM			Shaft Torque (N-m)			Power (kW)		
					Stbd	Port	Stbd	Port	Stbd	Port	Average	Stbd	Port	Total	Stbd	Port	Total
011S	4.87	-	-0.3	0.2	-6.8	7.2	5.0	21.7	86.9	64.7	75.8	3,050	1,085	4,140	25	10	35
020N	4.49	-	-0.9	0.9	-6.7	7.2	5.1	21.7	87.3	66.3	76.8	3,200	1,275	4,470	30	10	40
	4.68	-									76.3			4,310			40
040S	8.46	-	0	0.2	-2.4	4.5	3.9	8.2	150.4	156.3	153.4	8,770	10,590	19,360	140	175	315
050N	7.55	-	-0.5	0.8	-2.3	6.6	4.0	8.2	149.3	155.5	152.4	8,820	10,700	19,520	140	175	315
060S	8.37	-	1.3	0.3	-2.4	0.1	4.0	8.2	151.6	156.5	154.1	8,980	10,670	19,650	140	175	315
	7.98	-									153.0			19,510			315
070N	9.65	-	-0.5	0.9	-1.6	-0.7	-2.1	0	214.8	210.9	212.9	21,060	21,450	42,510	475	475	950
080S	9.92	-	0	0.4	-1.6	-0.7	-2.1	-8.1	216.2	212.2	214.2	21,230	21,670	42,900	480	480	960
	9.79	-									213.5			42,710			955
100N	12.99	-	0.7	1.0	-1.5	-0.6	4.8	7.4	241.5	237.7	239.6	23,130	24,740	47,870	585	615	1200
110S	13.34	-	0.7	0.5	-1.1	-1.0	8.7	10.7	243.9	239.1	241.5	23,520	24,730	48,250	600	620	1220
	13.17	-									240.6			48,060			1210
130N	14.90	-	-0.7	1.5	-5.9	-7.1	3.6	4.1	277.6	274.6	276.1	30,130	31,370	61,500	875	905	1780
140S	15.10	-	-0.4	0.7	-5.9	-7.5	3.3	3.8	282.0	276.2	279.1	31,160	31,250	62,410	920	905	1825
	15.00	-									277.6			61,960			1800
190N	17.44	-	-0.7	0.9	-0.9	-1.9	-1.9	-1.6	314.5	311.5	313.0	37,580	39,270	76,850	1240	1280	2520
200S	17.58	-	-0.1	0.2	-0.7	-2.0	-1.7	-1.8	316.9	311.9	314.4	38,100	39,140	77,240	1265	1280	2545
	17.51	-									313.7			77,050			2530

* + Trailing Edge Up
  - Trailing Edge Down
  } Canard and Stabilizer Flap Angles

  + Bow Up
  - Bow Down
  } Pitch

  + Stbd Roll
  - Port Roll

TABLE 7 - SSP KAIMALINO STANDARDIZATION TRIAL RESULTS, ENGLISH UNITS: 20 SEPTEMBER 1979, CALM WATER, HEAVY DISPLACEMENT = 237.8 TONS, STATICALLY TRIMMED BY THE STERN, FIXED CONTROL SURFACES

Run	Mini-ranger Speed (knots)	Doppler Log Speed (knots)	Average Pitch* (deg)	Average Roll* (deg)	Average Canard Angles* (deg)		Average Stabilizer Flap Angles* (deg)		Shaft RPM			Shaft Torque (ft-lbf)			Shaft Horsepower		
					Stbd	Port	Stbd	Port	Stbd	Port	Average	Stbd	Port	Total	Stbd	Port	Total
230S	7.68	-	-2.3	0.3	1.2	-4.7	14.9	10.7	151.5	152.3	151.9	6,610	6,580	13,190	190	190	380
240N	7.65	-	-2.8	0.9	-0.1	-3.3	13.5	12.2	150.9	151.3	151.1	6,660	6,570	13,230	190	190	380
	7.69	-									151.5			13,210			380
250S	9.72	-	-2.0	-0.2	-0.4	-3.0	5.5	4.3	211.1	211.2	211.2	14,350	14,290	28,640	575	575	1150
260N	9.58	-	-2.7	0.1	-1.4	-1.9	4.4	5.4	210.3	212.0	211.2	14,320	14,520	28,840	575	585	1160
	9.65	-									211.2			28,740			1155
280S	13.02	-	-2.2	0.1	1.7	-4.9	25.7	21.6	245.6	246.9	246.3	17,610	18,080	35,690	825	850	1675
290N	12.65	-	-2.5	1.8	1.4	-5.0	23.2	19.1	247.2	248.1	247.7	17,680	18,120	35,800	830	855	1685
	12.84	-									247.0			35,750			1680
300S	14.60	-	-2.6	1.1	1.6	-5.2	19.2	14.5	277.1	277.8	277.5	22,240	22,210	44,450	1175	1175	2350
310N	14.31	-	-3.1	-0.4	0.5	-4.0	18.0	15.6	279.2	278.5	278.9	22,700	22,350	45,050	1205	1185	2390
	14.46	-									278.2			44,750			2370
320S	17.67	-	-2.4	0.2	-0.1	-3.5	4.7	2.6	317.3	317.8	317.5	27,280	26,700	53,980	1650	1615	3265
330N	17.27	-	-3.2	0.8	0.4	-4.2	5.3	2.0	316.7	318.6	317.7	27,080	26,560	53,640	1635	1610	3245
	17.47	-									317.6			53,810			3255
340S**	15.18	-	1.3	0.5	-0.2	-3.4	0.2	-2.0	279.3	279.9	279.6	21,600	21,670	43,270	1150	1155	2305
350N**	14.78	-	0.8	0.5	-0.1	-3.5	0.1	-2.0	278.1	279.0	278.5	21,520	21,650	43,170	1140	1150	2290
	14.98	-									279.1			43,220			2295

* + Trailing Edge Up
  - Trailing Edge Down
  } Canard and Stabilizer Flap Angles

  + Bow Up
  - Bow Down
  } Pitch

  + Stbd Roll
  - Port Roll

** 0 deg flaps and canards

TABLE 8 - SSP KAIMALINO STANDARDIZATION TRIAL RESULTS, METRIC UNITS: 20 SEPTEMBER 1979, CALM WATER, HEAVY DISPLACEMENT = 241.6 METRIC TONS, STATICALLY TRIMMED BY THE STERN, FIXED CONTROL SURFACES

Run	Mini-ranger Speed (knots)	Doppler Log Speed (knots)	Average Pitch* (deg)	Average Roll* (deg)	Average Canard Angles* (deg)		Average Stabilizer Flap Angles* (deg)		Shaft RPM			Shaft Torque (N-m)			Power (kW)		
					Stbd	Port	Stbd	Port	Stbd	Port	Average	Stbd	Port	Total	Stbd	Port	Total
230S	7.68	-	-2.3	0.3	1.2	-4.7	14.9	10.7	151.5	152.3	151.9	8,960	8,920	17,880	140	140	280
240N	7.65	-	-2.8	0.9	-0.1	-3.3	13.5	12.2	150.9	151.3	151.1	9,030	8,910	17,940	140	140	280
	7.69	-									151.5			17,910			280
250S	9.72	-	-2.0	-0.2	-0.4	-3.0	5.5	4.3	211.1	211.2	211.2	19,460	19,370	38,830	430	430	860
260N	9.58	-	-2.7	0.1	-1.4	-1.9	4.4	5.4	210.3	212.0	211.2	19,410	19,690	39,100	430	435	865
	9.65	-									211.2			38,970			860
280S	13.02	-	-2.2	0.1	1.7	-4.9	25.7	21.6	245.6	246.9	246.3	23,880	24,510	48,390	615	635	1250
290N	12.65	-	-2.5	1.8	1.4	-5.0	23.2	19.1	247.2	248.1	247.7	23,970	24,570	48,540	620	640	1260
	12.84	-									247.0			48,470			1255
300S	14.60	-	-2.6	1.1	1.6	-5.2	19.2	14.5	277.1	277.8	277.5	30,150	30,110	60,260	875	875	1750
310N	14.31	-	-3.1	-0.4	0.5	-4.0	18.0	15.6	279.2	278.5	278.9	30,780	30,300	61,080	900	880	1780
	14.46	-									278.2			60,670			1765
320S	17.67	-	-2.4	0.2	-0.1	-3.5	4.7	2.6	317.3	317.8	317.5	36,990	36,200	73,190	1230	1205	2435
330N	17.27	-	-3.2	0.8	0.4	-4.2	5.3	2.0	316.7	318.6	317.7	36,720	36,010	72,730	1220	1200	2420
	17.47	-									317.6			72,960			2425
340S**	15.18	-	1.3	0.5	-0.2	-3.4	0.2	-2.0	279.3	279.9	279.6	29,290	29,380	58,670	860	860	1720
350N**	14.78	-	0.8	0.5	-0.1	-3.5	0.1	-2.0	278.1	279.0	278.5	29,180	29,350	58,530	850	855	1705
	14.98	-									279.1			58,600			1710

* + Trailing Edge Up
  - Trailing Edge Down
  } Canard and Stabilizer Flap Angles

  + Bow Up
  - Bow Down
  } Pitch

  + Stbd Roll
  - Port Roll

** 0 deg flaps and canards

TABLE 9 - SSP KAIMALINO STANDARDIZATION TRIAL RESULTS, ENGLISH UNITS: 21 SEPTEMBER 1979, CALM WATER, LIGHT DISPLACEMENT = 217.4 TONS, STATICALLY TRIMMED BY THE STERN, FIXED CONTROL SURFACES

Run	Mini-ranger Speed (knots)	Doppler Log Speed (knots)	Average Pitch* (deg)	Average Roll* (deg)	Average Canard Angles* (deg)		Average Stabilizer Flap Angles* (deg)		Shaft RPM			Shaft Torque (ft-lbf)			Shaft Horsepower		
					Stbd	Port	Stbd	Port	Stbd	Port	Average	Stbd	Port	Total	Stbd	Port	Total
360N	8.82	-	0.1	-0.2	1.3	-2.1	4.1	1.8	156.1	159.7	157.9	6,600	6,800	13,400	195	205	400
390S	7.77	-	-0.5	-0.4	1.5	-3.0	8.8	5.6	155.2	159.0	157.1	6,630	6,800	13,430	195	205	400
400N	8.86	-	-0.8	-0.4	-0.3	-1.1	6.3	7.0	155.6	159.5	157.5	6,600	6,780	13,380	195	205	400
	8.31	-									157.4			13,410			400
560S	11.45	-	0.3	0.3	0.7	-1.6	9.1	8.4	204.7	200.9	202.8	11,250	10,480	21,730	440	400	840
570N	9.25	-	-1.1	0.4	0.3	-1.3	-3.4	-4.2	195.4	194.6	195.0	11,730	10,810	22,540	435	400	835
580S	9.69	-	-0.4	-0.7	0.1	-1.0	-3.7	-3.9	197.0	194.5	195.8	11,870	10,750	22,620	445	400	845
	9.91	-									197.1			22,360			840
430S	11.17	-	0.3	-0.5	0.9	-2.4	10.7	9.3	201.9	210.1	206.0	10,410	12,020	22,430	400	480	880
440N	12.19	-	0	-0.7	-0.1	-1.6	10.3	10.8	205.0	210.9	208.0	10,840	12,010	22,850	425	480	905
470S	11.64	-	0	-0.7	0.7	-2.3	13.5	12.8	206.9	211.4	209.1	11,105	12,020	23,130	435	485	920
	11.80	-									207.8			22,810			900
480N	13.05	-	-0.2	-1.1	-0.1	-1.4	10.3	11.1	243.0	242.9	243.0	16,530	14,430	30,960	765	665	1430
500S	13.77	-	0.2	-0.5	0.5	-1.6	9.9	9.8	245.3	243.2	244.2	16,270	17,440	33,710	760	805	1565
510N	13.15	-	-0.5	-0.3	0	-1.0	9.3	10.4	245.6	242.8	244.2	16,480	17,550	34,030	770	810	1580
	13.46	-									243.9			33,100			1535
520N	14.90	-	-0.8	-1.0	-0.1	-0.9	1.3	2.0	277.5	277.7	277.6	20,640	22,480	43,120	1090	1190	2280
530S	15.67	-	0.3	-0.9	0.1	-1.2	0.9	1.2	278.5	277.4	278.0	20,870	22,440	43,310	1105	1185	2290
	15.29	-									277.8			43,210			2285
540N	17.18	-	-1.2	-0.1	-0.2	-0.8	-3.3	-3.0	312.8	315.8	314.3	26,100	25,370	51,470	1555	1525	3080
550S	18.47	-	4.2	-1.9	0.3	-1.1	-3.7	-4.3	315.2	318.3	316.7	26,200	25,300	51,500	1575	1535	3110
	17.83	-									315.5			51,490			3095
370N**	8.75	-	0.9	-1.0	-0.4	-0.8	-1.3	-0.6	156.7	160.4	158.6	6,660	6,840	13,500	200	210	410
380S**	8.07	-	1.4	-1.7	-0.5	-0.8	-1.3	-0.6	156.1	159.5	157.8	6,680	6,820	13,500	200	205	405
410N**	8.94	-	0.9	-0.4	-0.3	-1.1	-0.9	-0.7	155.8	160.0	157.9	6,570	6,810	13,380	195	205	400
	8.46	-									158.1			13,470			405
420S**	11.36	-	2.7	-1.5	-0.2	-1.3	-0.8	-0.7	205.5	210.8	208.2	10,880	12,030	22,910	425	485	910
420N**	12.30	-	2.3	-0.3	-0.3	-1.3	-1.2	-1.0	206.4	211.1	208.8	10,940	12,030	22,970	430	485	915
460S**	11.56	-	3.1	-1.4	-0.3	-1.2	-1.4	-1.1	207.9	211.1	209.5	11,070	11,980	23,050	440	480	920
	11.88	-									208.8			22,970			915

* + Trailing Edge Up
\- Trailing Edge Down
} Canard and Stabilizer Flap Angles

+ Bow Up
- Bow Down
} Pitch

+ Stbd Roll
- Port Roll

** 0 deg Control Surfaces

TABLE 10 - SSP KAIMALINO STANDARDIZATION TRIAL RESULTS, METRIC UNITS: 21 SEPTEMBER 1979, CALM WATER, LIGHT DISPLACEMENT = 220.9 METRIC TONS, STATICALLY TRIMMED BY THE STERN, FIXED CONTROL SURFACES

Run	Mini-ranger Speed (knots)	Doppler Log Speed (knots)	Average Pitch* (deg)	Average Roll* (deg)	Average Canard Angles* (deg)		Average Stabilizer Flap Angles* (deg)		Shaft RPM			Shaft Torque (N-m)			Power (kW)		
					Stbd	Port	Stbd	Port	Stbd	Port	Average	Stbd	Port	Total	Stbd	Port	Total
360N	8.82	-	0.1	-0.2	1.3	-2.1	4.1	1.8	156.1	159.7	157.9	8,950	9,220	18,170	145	155	300
390S	7.77	-	-0.5	-0.4	1.5	-3.0	8.8	5.6	155.2	159.0	157.1	8,990	9,220	18,210	145	155	300
400N	8.86	-	-0.8	-0.4	-0.3	-1.1	6.3	7.0	155.6	159.5	157.5	8,950	9,190	18,140	145	155	300
	8.31	-									157.4			18,180			300
560S	11.45	-	0.3	0.3	0.7	-1.6	9.1	8.4	204.7	200.9	202.8	15,250	14,210	29,460	330	300	630
570N	9.25	-	-1.1	0.4	0.3	-1.3	-3.4	-4.2	195.4	194.6	195.0	15,900	14,660	30,560	325	300	625
580S	9.69	-	-0.4	-0.7	0.1	-1.0	-3.7	-3.9	197.0	194.5	195.8	16,090	14,580	30,670	330	300	630
	9.91	-									197.1			30,310			625
430S	11.17	-	0.3	-0.5	0.9	-2.4	10.7	9.3	201.9	210.1	206.0	14,110	16,300	30,410	300	355	655
440N	12.19	-	0	-0.7	-0.1	-1.6	10.3	10.8	205.0	210.9	208.0	14,700	16,280	30,980	315	355	670
470S	11.64	-	0	-0.7	0.7	-2.3	13.5	12.8	206.9	211.4	209.1	15,060	16,300	31,360	325	360	685
	11.80	-									207.8			30,930			670
480N	13.05	-	-0.2	-1.1	-0.1	-1.4	10.3	11.1	243.0	242.9	243.0	22,410	19,570	41,980	570	495	1065
500S	13.77	-	0.2	-0.5	0.5	-1.6	9.9	9.8	245.3	243.2	244.2	22,060	23,640	45,700	565	600	1165
510N	13.15	-	-0.5	-0.3	0	-1.0	9.3	10.4	245.6	242.8	244.2	22,340	23,800	46,140	575	605	1180
	13.46	-									243.9			44,880			1145
520N	14.90	-	-0.8	-1.0	-0.1	-0.9	1.3	2.0	277.5	277.7	277.6	27,980	30,480	58,460	815	885	1700
530S	15.67	-	0.3	-0.9	0.1	-1.2	0.9	1.2	278.5	277.4	278.0	28,300	30,420	58,720	825	885	1710
	15.29	-									277.8			58,590			1705
540N	17.18	-	-1.2	-0.1	-0.2	-0.8	-3.3	-3.0	312.8	315.8	314.3	35,390	34,400	69,790	1160	1135	2295
550S	18.47	-	4.2	-1.9	0.3	-1.1	-3.7	-4.3	315.2	318.3	316.7	35,520	34,300	69,820	1175	1145	2320
	17.83	-									315.5			69,810			2310
370N**	8.75	-	0.9	-1.0	-0.4	-0.8	-1.3	-0.6	156.7	160.4	158.6	9,030	9,270	18,300	150	155	305
380S**	8.07	-	1.4	-1.7	-0.5	-0.8	-1.3	-0.6	156.1	159.5	157.8	9,060	9,240	18,300	150	150	300
410N**	8.94	-	0.9	-0.4	-0.3	-1.1	-0.9	-0.7	155.8	160.0	157.9	8,910	9,230	18,140	145	150	295
	8.46	-									158.1			18,260			300
420S**	11.36	-	2.7	-1.5	-0.2	-1.3	-0.8	-0.7	205.5	210.8	208.2	14,750	16,310	31,060	320	360	680
450N**	12.30	-	2.3	-0.3	-0.3	-1.3	-1.2	-1.0	206.4	211.1	208.8	14,830	16,310	31,140	320	360	680
460S**	11.56	-	3.1	-1.4	-0.3	-1.2	-1.4	-1.1	207.9	211.1	209.5	15,010	16,240	31,250	330	355	685
	11.88	-									208.8			31,140			680

* + Trailing Edge Up, - Trailing Edge Down } Canard and Stabilizer Flap Angles

+ Bow Up, - Bow Down } Pitch

+ Stbd Roll
- Port Roll

** 0 deg Control Surfaces

TABLE 11 - SSP KAIMALINO STANDARDIZATION TRIAL RESULTS, ENGLISH UNITS: 25 SEPTEMBER 1979, CALM WATER, HEAVY DISPLACEMENT = 237.8 TONS, STATICALLY 0 DEGREE TRIM, AUTOMATIC CONTROL SYSTEM

Run	Mini-ranger Speed (knots)	Doppler Log Speed (knots)	Average Pitch* (deg)	Average Roll* (deg)	Average Canard Angles* (deg)		Average Stabilizer Flap Angles* (deg)		Shaft RPM			Shaft Torque (ft-lbf)			Shaft Horsepower		
					Stbd	Port	Stbd	Port	Stbd	Port	Average	Stbd	Port	Total	Stbd	Port	Total
730S	7.86	7.6	-0.1	0.1	-17.3	-19.4	0.7	0.3	135.5	132.1	133.8	5,550	5,150	10,700	145	130	275
740N	6.03	7.6	-0.4	0.1	-18.4	-19.0	-0.7	0.7	126.2	137.5	131.8	4,480	5,840	10,320	105	155	260
	6.95	7.6									132.8			10,510			265
590S	7.60	8.6	-0.2	-0.1	-13.6	-17.1	**	0.4	155.9	158.6	157.3	7,280	7,120	14,400	215	215	430
600N	7.61	8.8	-0.3	0.2	-13.9	-17.9	1.4	-0.6	160.9	160.3	160.6	7,790	7,820	15,610	240	240	480
	7.61	8.7									159.0			15,000			455
610S	10.34	9.7	-0.6	0.1	-8.4	-12.8	-1.2	-4.1	213.7	216.2	215.0	14,940	16,090	31,030	610	660	1270
620N	9.19	9.6	-0.8	0	-9.6	-13.1	-4.0	-6.1	215.7	216.5	216.1	15,170	16,100	31,270	625	665	1290
630S	10.38	10.4	-0.8	-0.2	-8.8	-11.7	-1.9	-3.3	215.3	216.1	215.7	15,300	16,300	31,600	630	670	1300
	9.78	9.8									215.7			31,290			1290
650N	12.24	13.1	-0.1	0.1	-9.0	-10.9	8.1	8.5	234.7	234.5	234.6	15,550	16,740	32,290	695	750	1445
660S	13.58	13.2	0	0	-7.3	-10.5	10.0	8.9	234.2	233.7	233.9	15,590	16,710	32,300	695	745	1440
670N	12.23	13.3	-0.5	0.1	-7.6	-9.8	9.3	9.5	235.2	234.5	234.8	15,720	16,620	32,340	705	740	1445
	12.91	13.2									234.3			32,310			1440
680N	13.98	14.2	-0.5	0.5	-7.4	-9.8	3.9	3.3	279.5	277.6	278.6	22,330	23,310	45,640	1190	1230	2420
690S	15.93	15.2	-0.2	0.8	-6.9	-9.2	4.3	3.6	279.6	277.7	278.7	22,480	23,380	45,860	1200	1235	2435
700N	14.74	15.2	-0.6	0.2	-6.7	-9.5	2.6	1.1	280.4	279.0	279.7	22,290	23,200	45,490	1190	1235	2425
	15.15	15.0									278.9			45,710			2430
710S	17.83	17.2	-0.7	0.1	-5.4	-7.1	-2.1	-3.1	313.7	316.0	314.9	27,310	29,280	56,590	1630	1760	3395
720N	17.32	17.4	-1.0	0	-5.4	-7.8	-2.3	-3.7	314.1	316.7	315.4	27,150	29,160	56,310	1625	1760	3385
	17.58	17.3									315.1			56,450			3390

* + Trailing Edge Up
  - Trailing Edge Down
  } Canard and Stabilizer Flap Angles

  + Bow Up
  - Bow Down
  } Pitch

  + Stbd Roll
  - Port Roll

** Not instrumented

TABLE 12 - SSP KAIMALINO STANDARDIZATION TRIAL RESULTS, METRIC UNITS: 25 SEPTEMBER 1979, CALM WATER, HEAVY DISPLACEMENT = 241.6 METRIC TONS, STATICALLY 0 DEGREE TRIM, AUTOMATIC CONTROL SYSTEM

Run	Mini-ranger Speed (knots)	Doppler Log Speed (knots)	Average Pitch* (deg)	Average Roll* (deg)	Average Canard Angles* (deg)		Average Stabilizer Flap Angles* (deg)		Shaft RPM			Shaft Torque (N-m)			Power (kW)		
					Stbd	Port	Stbd	Port	Stbd	Port	Average	Stbd	Port	Total	Stbd	Port	Total
730S	7.86	7.6	-0.1	0.1	-17.3	-19.4	0.7	0.3	135.5	132.1	133.8	7,520	6,980	14,500	110	95	205
740N	6.03	7.6	-0.4	0.1	-18.4	-19.0	-0.7	0.7	126.2	137.5	131.8	6,070	7,920	13,990	80	115	195
	6.95	7.6									132.8			14,250			200
590S	7.60	8.6	-0.2	-0.1	-13.6	-17.1	**	0.4	155.9	158.6	157.3	9,870	9,650	19,520	160	160	320
600N	7.61	8.8	-0.3	0.2	-13.9	-17.9	1.4	-0.6	160.9	160.3	160.6	10,560	10,600	21,160	180	180	360
	7.61	8.7									159.0			20,340			340
610S	10.34	9.7	-0.6	0.1	-8.4	-12.8	-1.2	-4.1	213.7	216.2	215.0	20,260	21,820	42,080	455	490	945
620N	9.19	9.6	-0.8	0	-9.6	-13.1	-4.0	-6.1	215.7	216.5	216.1	20,570	21,830	42,400	465	495	960
630S	10.38	10.4	-0.8	-0.2	-8.8	-11.7	-1.9	-3.3	215.3	216.1	215.7	20,740	22,100	42,840	470	500	970
	9.78	9.8									215.7			42,430			960
650N	12.24	13.1	-0.1	0.1	-9.0	-10.9	8.1	8.5	234.7	234.5	234.6	21,080	22,700	43,780	520	560	1080
660S	13.58	13.2	0	0	-7.3	-10.5	10.0	8.9	234.2	233.7	233.9	21,140	22,660	43,800	520	555	1075
670N	12.23	13.3	-0.5	0.1	-7.6	-9.8	9.3	9.5	235.2	234.5	234.8	21,310	22,530	43,840	525	550	1075
	12.91	13.2									234.3			43,810			1075
680N	13.98	14.2	-0.5	0.5	-7.4	-9.8	3.9	3.3	279.5	277.6	278.6	30,280	31,600	61,880	885	920	1805
690S	15.93	15.2	-0.2	0.8	-6.9	-9.2	4.3	3.6	279.6	277.7	278.7	30,480	31,700	62,180	895	920	1815
700N	14.74	15.2	-0.6	0.2	-6.7	-9.5	2.6	1.1	280.4	279.0	279.7	30,220	31,460	61,680	885	920	1805
	15.15	15.0									278.9			61,980			1810
710S	17.83	17.2	-0.7	0.1	-5.4	-7.1	-2.1	-3.1	313.7	316.0	314.9	37,030	39,700	76,730	1215	1315	2530
720N	17.32	17.4	-1.0	0	-5.4	-7.8	-2.3	-3.7	314.1	316.7	315.4	36,810	39,540	76,350	1210	1315	2525
	17.58	17.3									315.1			76,540			2530

* + Trailing Edge Up
  - Trailing Edge Down
  } Canard and Stabilizer Flap Angles

  + Bow Up
  - Bow Down
  } Pitch

  + Stbd Roll
  - Port Roll

** Not instrumented

TABLE 13 - SSP KAIMALINO STANDARDIZATION TRIAL RESULTS, ENGLISH UNITS: 27 SEPTEMBER 1979, ROUGH WATER, MEDIUM DISPLACEMENT = 228.4 TONS, STATICALLY TRIMMED BY THE STERN, AUTOMATIC CONTROL SYSTEM

Run	Mini-ranger Speed (knots)	Doppler Log Speed (knots)	True Wind		Type of Sea	Average Pitch* (deg)	Average Roll* (deg)	Average Rudder Angles* (deg)		Average Canard Angles* (deg)		Average Stabilizer Flap Angles* (deg)		Shaft RPM			Shaft Torque (ft-lbf)			Shaft Horsepower		
			Direction (deg)	Speed (knots)				Stbd	Port	Stbd	Port	Stbd	Port	Stbd	Port	Average	Stbd	Port	Total	Stbd	Port	Total
750	7.46	8.4	64	10	Head	-0.2	-0.1	-0.9	0.1	0.8	-2.4	3.3	1.5	154.8	150.5	152.6	7,080	6,470	13,550	210	185	395
760	7.81	8.6	67	9	Stbd Bow Quartering	-0.3	-0.2	-1.5	-0.5	2.0	-3.7	4.4	0	156.2	151.6	153.9	7,180	6,680	13,860	215	195	410
770	8.24	8.6	86	11	Stbd Beam	-0.4	-0.3	-1.4	-0.7	2.5	-4.0	4.7	-0.5	155.4	150.3	152.9	7,090	6,520	13,610	210	185	395
780	8.53	8.6	84	12	Stbd Stern Quartering	-0.5	-0.2	-1.3	-0.3	1.9	-3.4	3.5	-0.6	157.3	152.1	152.1	7,210	6,610	13,820	215	190	405
790	8.22	8.8	77	13	Following	-0.4	-0.2	-0.9	0.2	1.2	-2.6	2.2	-0.2	155.1	150.5	152.8	6,980	6,450	13,430	205	185	390
800	7.53	8.7	77	13	Port Beam	-0.3	-0.1	-0.3	0.5	-0.5	-0.8	1.3	2.5	155.9	150.8	153.4	7,160	6,490	13,650	215	185	400
	7.89	8.7														153.1			13,630			400
1040	8.83	10.2	53	6	Stbd Beam	-1.0	-0.9	-0.4	0.4	0.5	-2.2	-0.2	-1.8	205.8	200.6	203.2	13,230	12,690	25,920	520	485	1005
1050	10.21	10.3	66	7	Port Beam	-1.4	0.2	-0.5	0.3	4.7	-6.6	4.8	-5.5	206.8	199.7	203.3	13,730	12,900	26,630	540	490	1030
	9.52	10.3														203.3			26,270			1015
810	11.16	12.2	53	10	Head	0	0.1	0.1	1.0	0.8	-2.7	10.3	8.5	212.8	214.3	213.6	12,400	13,750	26,150	500	560	1060
820	12.19	12.3	71	8	Stbd Bow Quartering	-0.3	0.4	-0.3	0.5	1.5	-3.5	13.2	10.0	226.7	221.9	224.3	14,550	14,620	29,170	630	620	1250
830	12.65	11.2	90	11	Stbd Beam	-0.4	0.4	-0.4	0.4	2.0	-4.0	14.1	10.4	226.4	222.4	224.4	14,650	14,740	29,390	630	625	1255
840	13.00	12.0	85	13	Stbd Stern Quartering	-0.8	0	-1.3	0.9	1.2	-3.0	12.9	11.1	227.1	223.4	225.3	14,480	14,740	29,220	625	625	1250
850	13.06	12.8	80	13	Following	-0.3	0.3	0.8	1.7	0.4	-2.1	8.9	8.5	228.4	224.6	226.5	14,220	14,620	28,840	620	625	1245
860	11.96	12.6	67	13	Port Beam	0.1	-0.2	0.7	1.5	-0.1	-1.7	9.1	9.1	227.3	223.3	225.3	14,370	14,750	29,120	620	625	1250
	12.31	11.9														224.8			29,250			1250
870	13.67	14.6	40	12	Head	-0.6	0	-0.8	0	0.7	-2.6	5.8	4.0	277.6	276.3	277.0	22,150	19,910	42,060	1170	1045	2215
880	14.46	14.2	72	10	Stbd Bow Quartering	-0.6	0.5	-0.9	-0.2	1.0	-2.9	6.7	4.3	276.3	275.6	276.0	21,920	20,030	41,950	1155	1050	2205
890	14.93	13.2	68	6	Stbd Beam	-0.8	0.5	-1.2	-0.7	1.6	-3.5	7.9	4.4	276.9	275.9	276.4	22,110	20,030	42,140	1165	1050	2215
900	15.50	14.0	74	10	Stbd Stern Quartering	-1.2	0.7	-0.8	0	1.8	-3.7	7.4	3.6	279.0	278.2	278.6	22,060	19,900	41,960	1170	1055	2225
1020	15.18	13.9	69	14	Following	-0.5	-0.2	-0.3	0.5	-1.0	-6.3	7.0	3.4	269.3	269.0	269.1	19,470	21,340	40,810	1000	1095	2095
1030	14.62	15.3	59	9	Port Beam	-0.5	-0.4	0.1	0.8	0.8	-2.7	4.2	2.2	282.0	280.2	281.1	21,430	22,990	44,420	1150	1225	2375
	14.78	14.3														278.8			43,280			2295
950	18.32	15.4	112	6	Stbd Beam	-1.0	0.9	-1.0	-0.3	1.3	-3.3	-1.7	-5.1	322.4	318.3	320.4	28,130	28,970	57,100	1725	1755	3480
960	19.53	16.9	112	10	Stbd Stern Quartering	-1.2	0.5	-0.1	0.6	0.6	-2.5	-2.0	-4.0	324.2	321.9	323.1	27,320	28,530	55,850	1685	1750	3435
970	19.50	18.3	96	13	Following	-1.3	0.3	-0.5	0.1	0.7	-2.7	-2.4	-4.7	324.5	322.2	323.4	27,220	28,560	55,780	1680	1750	3435
980	17.34	17.5	63	12	Port Beam	-0.8	-0.2	0.4	0.9	0.7	-2.6	-1.6	-3.8	322.4	320.8	321.6	27,340	28,780	56,120	1680	1760	3440
990	17.52	17.3	17	8	Head	-0.8	0.3	0.1	0.4	0.9	-2.9	-2.4	-5.4	322.5	320.1	321.3	27,370	28,820	56,190	1680	1755	3440
1000	18.01	16.0	65	7	Stbd Bow Quartering	-0.8	0.4	-0.7	-0.2	0.9	-2.9	-1.7	-4.7	321.5	319.1	320.3	27,360	28,770	56,130	1675	1750	3425
	17.83	16.5														321.0			56,610			3460
1010	17.62	14.6	103	11	Wave Profile Run	0.2	0.2	-0.7	-0.3	-1.9	-6.1	-5.7	-9.5	320.1	318.2	319.2	27,460	28,940	56,400	1675	1755	3430

* + Trailing Edge Up
- Trailing Edge Down
} Canards and Stabilizer Flap Angles

+ Bow Up
- Bown Down
} Pitch

+ Stbd Roll
- Port Roll

+ Left Rudder
- Right Rudder

TABLE 14 - SSP KAIMALINO STANDARDIZATION TRIAL RESULTS, METRIC UNITS: 27 SEPTEMBER 1979, ROUGH WATER, MEDIUM DISPLACEMENT = 232.1 METRIC TONS, STATICALLY TRIMMED BY THE STERN, AUTOMATIC CONTROL SYSTEM

Run	Mini-ranger Speed (knots)	Doppler Log Speed (knots)	True Wind		Type of Sea	Average Pitch* (deg)	Average Roll* (deg)	Average Rudder Angles* (deg)		Average Canard Angles* (deg)		Average Stabilizer Flap Angles* (deg)		Shaft RPM			Shaft Torque (N-m)			Power (kW)		
			Direction (deg)	Speed (knots)				Stbd	Port	Stbd	Port	Stbd	Port	Stbd	Port	Average	Stbd	Port	Total	Stbd	Port	Total
750	7.46	8.4	64	10	Head	-0.2	-0.1	-0.9	0.1	0.8	-2.4	3.3	1.5	154.8	150.5	152.6	9,600	8,770	18,370	155	140	295
760	7.81	8.6	67	9	Stbd Bow Quartering	-0.3	-0.2	-1.5	-0.5	2.0	-3.7	4.4	0	156.2	151.6	153.9	9,730	9,060	18,790	160	145	305
770	8.24	8.6	86	11	Stbd Beam	-0.4	-0.3	-1.4	-0.7	2.5	-4.0	4.7	-0.5	155.4	150.3	152.9	9,610	8,840	18,450	155	140	295
780	8.53	8.6	84	12	Stbd Stern Quartering	-0.5	-0.2	-1.3	-0.3	1.9	-3.4	3.5	-0.6	157.3	152.1	152.1	9,780	8,960	18,740	160	140	300
790	8.22	8.8	77	13	Following	-0.4	-0.2	-0.9	0.2	1.2	-2.6	2.2	-0.2	155.1	150.5	152.8	9,460	8,750	18,210	150	140	290
800	7.53	8.7	77	13	Port Beam	-0.3	-0.1	-0.3	0.5	-0.5	-0.8	1.3	2.5	155.9	150.8	153.4	9,710	8,800	18,510	160	140	300
	7.89	8.7														153.1			18,480			300
1040	8.83	10.2	53	6	Stbd Beam	-1.0	-0.9	-0.4	0.4	0.5	-2.2	-0.2	-1.8	205.8	200.6	203.2	17,940	17,200	35,140	390	360	750
1050	10.21	10.3	66	7	Port Beam	-1.4	0.2	-0.5	0.3	4.7	-6.6	4.8	-5.5	206.8	199.7	203.3	18,620	17,490	36,110	405	365	770
	9.52	10.3														203.3			35,620			760
810	11.16	12.2	53	10	Head	0	0.1	0.1	1.0	0.8	-2.7	10.3	8.5	212.8	214.3	213.6	16,810	18,640	35,450	370	420	790
820	12.19	12.3	71	8	Stbd Bow Quartering	-0.3	0.4	-0.3	0.5	1.5	-3.5	13.2	10.0	226.7	221.9	224.3	19,730	19,820	39,550	470	465	935
830	12.65	11.2	90	11	Stbd Beam	-0.4	0.4	-0.4	0.4	2.0	-4.0	14.1	10.4	226.4	222.4	224.4	19,860	19,990	39,850	470	465	935
840	13.00	12.0	85	13	Stbd Stern Quartering	-0.8	0	-1.3	0.9	1.2	-3.0	12.9	11.1	227.1	223.4	225.3	19,630	19,990	39,620	465	465	930
850	13.06	12.8	80	13	Following	-0.3	0.3	0.8	1.7	0.4	-2.1	8.9	8.5	228.4	224.6	226.5	19,280	19,820	39,100	465	465	930
860	11.96	12.6	67	13	Port Beam	0.1	-0.2	0.7	1.5	-0.1	-1.7	9.1	9.1	227.3	223.3	225.3	19,480	20,000	39,480	465	465	930
	12.31	11.9														224.8			39,660			930
870	13.67	14.6	40	12	Head	-0.6	0	-0.8	0	0.7	-2.6	5.8	4.0	277.6	276.3	277.0	30,030	27,000	57,030	875	780	1655
880	14.46	14.2	72	10	Stbd Bow Quartering	-0.6	0.5	-0.9	-0.2	1.0	-2.9	6.7	4.3	276.3	275.6	276.0	29,720	27,160	56,880	860	785	1645
890	14.93	13.2	68	6	Stbd Beam	-0.8	0.5	-1.2	-0.7	1.6	-3.5	7.9	4.4	276.9	275.9	276.4	29,980	27,160	57,140	870	785	1655
900	15.50	14.0	74	10	Stbd Stern Quartering	-1.2	0.7	-0.8	0	1.8	-3.7	7.4	3.6	279.0	278.2	278.6	29,910	26,980	56,890	875	785	1660
1020	15.18	13.9	69	14	Following	-0.5	-0.2	-0.3	0.5	-1.0	-6.3	7.0	3.4	269.3	269.0	269.1	26,400	28,930	55,330	745	815	1560
1030	14.62	15.3	59	9	Port Beam	-0.5	-0.4	0.1	0.8	0.8	-2.7	4.2	2.2	282.0	280.2	281.1	29,050	31,170	60,220	855	915	1770
	14.78	14.3														278.8			58,680			1710
950	18.32	15.4	112	6	Stbd Beam	-1.0	0.9	-1.0	-0.3	1.3	-3.3	-1.7	-5.1	322.4	318.3	320.4	38,140	39,280	77,420	1285	1310	2595
960	19.53	16.9	112	10	Stbd Stern Quartering	-1.2	0.5	-0.1	0.6	0.6	-2.5	-2.0	-4.0	324.2	321.9	323.1	37,040	38,680	75,720	1255	1305	2560
970	19.50	18.3	96	13	Following	-1.3	0.3	-0.5	0.1	0.7	-2.7	-2.4	-4.7	324.5	322.2	323.4	36,910	38,720	75,630	1255	1305	2560
980	17.34	17.5	63	12	Port Beam	-0.8	-0.2	0.4	0.9	0.7	-2.6	-1.6	-3.8	322.4	320.8	321.6	37,070	39,020	76,090	1255	1310	2565
990	17.52	17.3	17	8	Head	-0.8	0.3	0.1	0.4	0.9	-2.9	-2.4	-5.4	322.5	320.1	321.3	37,110	39,070	76,180	1255	1310	2565
1000	18.01	16.0	65	7	Stbd Bow Quartering	-0.8	0.4	-0.7	-0.2	0.9	-2.9	-1.7	-4.7	321.5	319.1	320.3	37,090	39,010	76,100	1250	1305	2555
	17.83	16.5														321.0			76,750			2580
1010	17.62	14.6	103	11	Wave Profile Run	0.2	0.2	-0.7	-0.3	-1.9	-6.1	-5.7	-9.5	320.1	318.2	319.2	37,230	39,240	76,470	1250	1310	2560

* + Trailing Edge Up
- Trailing Edge Down
} Canard and Stabilizer Flap Angles

+ Bow Up
- Bow Down
} Pitch

+ Stbd Roll
- Port Roll

+ Left Rudder
- Right Rudder

TABLE 15 - SSP KAIMALINO STANDARDIZATION TRIAL RESULTS, ENGLISH UNITS: 28 SEPTEMBER 1979, ROUGH WATER, LIGHT DISPLACEMENT = 215.0 TONS, STATICALLY TRIMMED BY THE STERN, FIXED CONTROL SURFACES

Run	Mini-ranger Speed (knots)	Doppler Log Speed (knots)	True Wind		Type of Sea	Average Pitch* (deg)	Average Roll* (deg)	Average Rudder Angles* (deg)		Average Canard Angles* (deg)		Average Stabilizer Flap Angles* (deg)		Shaft RPM			Shaft Torque (ft-lbf)			Shaft Horsepower		
			Direction (deg)	Speed (knots)				Stbd	Port	Stbd	Port	Stbd	Port	Stbd	Port	Average	Stbd	Port	Total	Stbd	Port	Total
1060	7.94	8.9	57	8	Head	-0.3	-0.1	-0.1	0.8	-2.1	-3.6	4.9	5.3	156.6	161.9	159.3	6,880	7,060	13,940	205	220	425
1070	9.10	8.8	89	8	Stbd Beam	-0.5	-1.8	-0.8	0.1	-2.1	-3.6	4.9	5.3	157.0	161.8	159.4	6,870	7,080	13,950	205	220	425
1080	9.06	8.8	107	12	Following	-1.1	-0.5	-0.5	0.4	-2.1	-3.6	4.9	5.3	157.0	162.3	159.6	6,830	7,030	13,860	205	215	420
1090	8.13	9.0	75	10	Port Beam	-0.6	0.5	0.7	1.5	-2.1	-3.6	4.9	5.3	157.4	163.8	160.6	6,860	7,140	14,000	205	225	430
	8.62	8.9														160.0			13,970			425
1100	8.85	9.4	55	7	Head	-0.7	-0.2	-0.6	0.2	-0.8	-2.1	-5.0	-5.3	188.8	194.7	191.8	10,630	10,730	21,360	380	400	780
1110	10.03	9.4	97	6	Stbd Beam	-0.7	-1.1	-0.9	-0.1	-1.0	-2.0	-5.1	-5.2	189.4	194.3	191.8	10,610	10,670	21,280	385	395	780
1120	10.05	9.5	90	10	Following	-1.1	-0.6	-0.5	0.4	-1.0	-2.0	-5.1	-5.2	189.7	195.1	192.4	10,600	10,620	21,220	385	395	780
1130	8.95	9.6	76	9	Port Beam	-0.7	0.2	-0.2	0.7	-1.0	-2.1	-5.1	-5.2	189.5	195.2	192.4	10,640	10,670	21,310	385	395	780
	9.49	9.5														192.1			21,300			780
1140	11.37	11.3	49	6	Head	0.6	1.7	1.4	2.1	-1.8	-4.2	10.2	9.9	207.3	210.0	208.7	11,430	11,450	22,880	450	460	910
1150	12.37	11.2	105	5	Stbd Beam	0.1	-1.1	-1.1	-0.4	-1.0	-5.0	11.6	9.6	206.0	209.9	208.0	11,230	11,610	22,840	440	465	905
1160	12.01	11.1	86	12	Following	-1.6	0	-0.5	0.4	-1.1	-5.0	8.8	6.8	202.8	208.6	205.7	11,350	11,710	23,060	440	465	905
1170	11.23	11.4	80	11	Port Beam	0	-1.8	-1.4	-0.5	-3.2	-2.7	9.0	11.7	205.4	210.6	208.0	11,380	11,680	23,060	445	470	915
	11.80	11.3														208.0			22,950			910
1180	12.69	12.4	61	9	Head	0.1	-0.2	-0.4	0.5	-0.5	-2.9	9.9	9.3	241.8	245.8	243.8	16,050	16,030	32,080	740	750	1490
1190	13.86	12.7	104	7	Stbd Beam	-0.2	1.1	-0.2	0.6	0.5	-3.9	10.8	8.3	244.1	246.6	245.4	16,520	16,050	32,570	765	755	1520
1200	13.76	12.8	91	15	Following	-0.3	-3.5	-3.3	-2.3	-1.1	-2.3	9.3	9.9	243.8	237.9	240.8	16,510	16,670	33,180	765	755	1520
1210	12.76	12.8	79	12	Port Beam	-0.1	-0.4	-0.3	0.4	-1.3	-2.1	9.1	10.2	244.3	240.1	242.2	16,460	16,610	33,070	765	760	1525
	13.31	12.8														243.8			32,820			1525
1220	14.54	13.8	54	8	Head	0.2	-0.3	-0.5	0.2	-0.3	-1.9	0.5	0.2	277.5	273.9	275.7	21,310	21,330	42,640	1125	1110	2235
1230	15.60	14.2	103	8	Stbd Beam	-0.1	-0.4	-0.6	0.1	-3.5	-2.2	0.9	-0.2	276.6	273.4	275.0	21,030	21,250	42,280	1110	1105	2215
1240	15.56	14.2	96	17	Following	-0.6	0.2	-0.8	-1.3	-5.5	-2.2	0.8	-0.2	276.6	274.0	275.3	20,990	21,180	42,170	1105	1105	2210
1250	14.52	14.2	70	13	Port Beam	0.3	-0.6	-0.1	0.7	-0.9	-1.4	0.1	0.9	276.0	273.2	274.6	20,970	21,290	42,260	1100	1105	2210
	15.06	14.2														274.8			42,270			2210
1260	17.05	17.3	45	9	Head	-0.6	-0.9	-0.2	0.1	-1.0	-1.3	-4.2	-3.7	307.1	308.4	307.8	25,290	26,380	51,670	1480	1550	3030
1270	18.03	16.2	109	6	Stbd Beam	-1.1	-1.4	-1.1	-0.5	-1.1	-1.3	-4.1	-3.5	308.2	308.8	308.5	25,320	26,440	51,760	1485	1555	3040
1280	17.68	15.8	102	16	Following	-0.5	-0.6	-0.7	-0.2	-1.0	-1.3	-4.0	-3.5	307.5	307.5	307.5	25,320	26,470	51,790	1485	1550	3035
1290	17.02	16.5	73	13	Port Beam	-0.8	-0.6	0.3	0.9	-1.1	-1.3	-4.1	-3.5	307.9	308.5	308.2	25,310	26,390	51,700	1485	1550	3035
	17.53	16.4														308.3			51,730			3035

* + Trailing Edge Up, - Trailing Edge Down } Canards and Stabilizer Flap Angles

+ Bow Up, - Bow Down } Pitch

+ Stbd Roll
- Port Roll

+ Left Rudder
- Right Rudder

TABLE 16 - SSP KAIMALINO STANDARDIZATION TRIAL RESULTS, METRIC UNITS: 28 SEPTEMBER 1979, ROUGH WATER, LIGHT DISPLACEMENT = 218.4 METRIC TONS, STATICALLY TRIMMED BY THE STERN, FIXED CONTROL SURFACES

Run	Mini-ranger Speed (knots)	Doppler Log Speed (knots)	True Wind		Type of Sea	Average Pitch* (deg)	Average Roll* (deg)	Average Rudder Angles* (deg)		Average Canard Angles* (deg)		Average Stabilizer Flap Angles* (deg)		Shaft RPM			Shaft Torque (N-m)			Power (kW)		
			Direction (deg)	Speed (knots)				Stbd	Port	Stbd	Port	Stbd	Port	Stbd	Port	Average	Stbd	Port	Total	Stbd	Port	Total
1060	7.94	8.9	57	8	Head	-0.3	-0.1	-0.1	0.8	-2.1	-3.6	4.9	5.3	156.6	161.9	159.3	9,330	9,570	18,900	155	165	320
1070	9.10	8.8	89	8	Stbd Beam	-0.5	-1.8	-0.8	0.1	-2.1	-3.6	4.9	5.3	157.0	161.8	159.4	9,310	9,600	18,910	155	165	320
1080	9.06	8.8	107	12	Following	-1.1	-0.5	-0.5	0.4	-2.1	-3.6	4.9	5.3	157.0	162.3	159.6	9,260	9,530	18,790	155	160	315
1090	8.13	9.0	75	10	Port Beam	-0.6	0.5	0.7	1.5	-2.1	-3.6	4.9	5.3	157.4	163.8	160.6	9,300	9,680	18,980	155	170	320
	8.62	8.9														160.0			18,940			320
1100	8.85	9.4	55	7	Head	-0.7	-0.2	-0.6	0.2	-0.8	-2.1	-5.0	-5.3	188.8	194.7	191.8	14,410	14,550	28,960	280	300	580
1110	10.03	9.4	97	6	Stbd Beam	-0.7	-1.1	-0.9	-0.1	-1.0	-2.0	-5.1	-5.2	189.4	194.3	191.8	14,380	14,470	28,850	285	295	580
1120	10.05	9.5	90	10	Following	-1.1	-0.6	-0.5	0.4	-1.0	-2.0	-5.1	-5.2	189.7	195.1	192.4	14,370	14,400	28,770	285	295	580
1130	8.95	9.6	76	9	Port Beam	-0.7	0.2	-0.2	0.7	-1.0	-2.1	-5.1	-5.2	189.5	195.2	192.4	14,430	14,470	28,900	285	295	580
	9.49	9.5														192.1			28,880			580
1140	11.37	11.3	49	6	Head	0.6	1.7	1.4	2.1	-1.8	-4.2	10.2	9.9	207.3	210.0	208.7	15,500	15,520	31,020	335	345	680
1150	12.37	11.2	105	5	Stbd Beam	0.1	-1.1	-1.1	-0.4	-1.0	-5.0	11.6	9.6	206.0	209.9	208.0	15,230	15,740	30,970	330	345	675
1160	12.01	11.1	86	12	Following	-1.6	0	-0.5	0.4	-1.1	-5.0	8.8	6.8	202.8	208.6	205.7	15,390	15,880	31,270	330	345	675
1170	11.23	11.4	80	11	Port Beam	0	-1.8	-1.4	-0.5	-3.2	-2.7	9.0	11.7	205.4	210.6	208.0	15,430	15,840	31,270	330	350	680
	11.80	11.3														208.0			31,120			680
1180	12.69	12.4	61	9	Head	0.1	-0.2	-0.4	0.5	-0.5	-2.9	9.9	9.3	241.8	245.8	243.8	21,760	21,730	43,490	550	560	1110
1190	13.86	12.7	104	7	Stbd Beam	-0.2	1.1	-0.2	0.6	0.5	-3.9	10.8	8.3	244.1	246.6	245.4	22,400	21,760	44,160	570	565	1135
1200	13.76	12.8	91	15	Following	-0.3	-3.5	-3.3	-2.3	-1.1	-2.3	9.3	9.9	243.8	237.9	240.8	22,390	22,600	44,990	570	565	1135
1210	12.76	12.8	79	12	Port Beam	-0.1	-0.4	-0.3	0.4	-1.3	-2.1	9.1	10.2	244.3	240.1	242.2	22,320	22,520	44,840	570	565	1135
	13.31	12.8														243.8			44,500			1135
1220	14.54	13.8	54	8	Head	0.2	-0.3	-0.5	0.2	-0.3	-1.9	0.5	0.2	277.5	273.9	275.7	28,890	28,920	57,810	840	825	1665
1230	15.60	14.2	103	8	Stbd Beam	-0.1	-0.4	-0.6	0.1	-3.5	-2.2	0.9	-0.2	276.6	273.4	275.0	28,510	28,810	57,320	825	825	1650
1240	15.56	14.2	96	17	Following	-0.6	0.2	-0.8	-1.3	-5.5	-2.2	0.8	-0.2	276.6	274.0	275.3	28,460	28,720	57,180	825	825	1650
1250	14.52	14.2	70	13	Port Beam	0.3	-0.6	-0.1	0.7	-0.9	-1.4	0.1	0.9	276.0	273.2	274.6	28,430	28,870	57,300	825	825	1650
	15.06	14.2														274.8			57,310			1650
1260	17.05	17.3	45	9	Head	-0.6	-0.9	-0.2	0.1	-1.0	-1.3	-4.2	-3.7	307.1	308.4	307.8	34,290	35,770	70,060	1105	1155	2260
1270	18.03	16.2	109	6	Stbd Beam	-1.1	-1.4	-1.1	-0.5	-1.1	-1.3	-4.1	-3.5	308.2	308.8	308.5	34,330	35,850	71,180	1105	1160	2265
1280	17.68	15.8	102	16	Following	-0.5	-0.6	-0.7	-0.2	-1.0	-1.3	-4.0	-3.5	307.5	307.5	307.5	34,330	35,890	70,220	1105	1155	2260
1290	17.02	16.5	73	13	Port Beam	-0.8	-0.6	0.3	0.9	-1.1	-1.3	-4.1	-3.5	307.9	308.5	308.2	34,320	35,780	70,100	1105	1155	2260
	17.53	16.4														308.3			70,140			2265

* + Trailing Edge Up
- Trailing Edge Down
} Canards and Stabilizer Flap Angles

+ Bow Up
- Bow Down
} Pitch

+ Stbd Roll
- Port Roll

+ Left Rudder
- Right Rudder

TABLE 17 - SSP KAIMALINO STANDARDIZATION TRIAL RESULTS, ENGLISH UNITS: 2 OCTOBER 1979, CALM WATER, MEDIUM DISPLACEMENT = 226.7 TONS, STATICALLY TRIMMED BY THE STERN, FIXED CONTROL SURFACES

Run	Mini-ranger Speed (knots)	Doppler Log Speed (knots)	Average Pitch* (deg)	Average Roll* (deg)	Average Canard Angles* (deg)		Average Stabilizer Flap Angles* (deg)		Shaft RPM			Shaft Torque (ft-lbf)			Shaft Horsepower		
					Stbd	Port	Stbd	Port	Stbd	Port	Average	Stbd	Port	Total	Stbd	Port	Total
1460S	8.02	6.5	-0.3	0.3	-5.7	1.4	-4.7	4.3	128.9	131.7	130.3	4,700	4,720	9,420	115	120	235
1470N	5.93	6.4	-0.8	-0.3	-5.7	1.4	-4.7	4.3	128.3	129.2	128.8	4,730	4,550	9,280	115	110	225
1480S	8.05	6.3	-0.3	0.2	-5.7	1.3	-4.7	4.3	126.8	130.9	128.8	4,500	4,630	9,130	110	115	225
	6.98	6.4									129.2			9,280			230
1300N	7.93	8.3	-0.1	0.4	-0.8	-1.7	0.5	0.8	158.7	158.7	158.7	7,210	7,880	15,090	215	240	455
1310S	8.76	8.3	0.3	0.7	-1.4	-1.1	-0.1	1.5	159.1	159.5	159.3	7,260	8,020	15,280	220	245	465
	8.35	8.3									159.0			15,190			460
1330S	9.83	7.9	-2.0	0.5	-3.9	-4.5	1.9	2.9	191.7	195.9	193.8	11,360	12,860	24,220	415	480	895
1340N	8.90	7.6	-2.3	-0.1	-3.9	-4.5	1.9	2.9	191.5	196.2	193.9	11,250	12,940	24,190	410	485	895
1350S	9.85	7.8	-1.6	0.1	-4.6	-3.7	-0.6	1.7	191.0	196.2	193.6	11,250	12,970	24,220	410	485	895
	9.37	7.7									193.8			24,200			895
1360S	13.39	10.1	0.3	0.4	-2.2	-2.2	7.7	9.7	231.3	227.1	229.2	14,950	15,720	30,670	660	680	1340
1370N	12.25	10.4	0	0.8	-1.7	-3.1	8.6	9.3	230.9	227.6	229.3	14,840	15,920	30,760	650	690	1340
1380S	13.53	10.6	0.3	-0.1	-2.8	-2.1	7.6	10.3	231.2	228.1	229.6	14,920	15,990	30,910	655	695	1350
	12.86	10.4									229.3			30,780			1345
1390N	13.94	12.8	-0.8	1.1	-1.0	-3.5	5.0	4.0	268.3	272.5	270.4	19,990	22,670	42,660	1020	1175	2195
1400S	15.55	11.9	-0.6	-0.1	-2.0	-2.5	4.0	5.1	269.1	273.2	271.2	19,990	22,850	42,840	1025	1190	2215
1410N	13.86	12.3	-0.6	-0.6	-2.0	-2.4	4.0	5.1	268.3	271.9	270.2	19,990	22,910	42,900	1020	1185	2205
	14.73	12.2									270.7			42,810			2210
1420S	18.89	14.2	-2.3	-0.5	-2.3	-2.2	-1.1	0.5	318.2	319.8	319.0	27,180	29,310	56,490	1645	1785	3430
1430N	17.01	15.0	-2.6	-1.7	-2.4	-2.3	-1.2	0.4	316.6	317.8	317.2	27,440	29,460	56,900	1655	1785	3440
1440S	18.90	14.0	-2.6	-0.2	-2.4	-2.3	-1.1	0.4	319.8	320.7	320.2	27,600	29,350	56,950	1680	1795	3475
	17.95	14.6									318.4			56,810			3445

* + Trailing Edge Up
  - Trailing Edge Down
  } Canard and Stabilizer Flap Angles

  + Bow Up
  - Bow Down
  } Pitch

  + Stbd Roll
  - Port Roll

TABLE 18 - SSP KAIMALINO STANDARDIZATION TRIAL RESULTS, METRIC UNITS: 2 OCTOBER 1979, CALM WATER, MEDIUM DISPLACEMENT = 230.3 METRIC TONS, STATICALLY TRIMMED BY THE STERN, FIXED CONTROL SURFACES

Run	Mini-ranger Speed (knots)	Doppler Log Speed (knots)	Average Pitch* (deg)	Average Roll* (deg)	Average Canard Angles* (deg)		Average Stabilizer Flap Angles* (deg)		Shaft RPM			Shaft Torque (N-m)			Power (kW)		
					Stbd	Port	Stbd	Port	Stbd	Port	Average	Stbd	Port	Total	Stbd	Port	Total
1460S	8.02	6.5	-0.3	0.3	-5.7	1.4	-4.7	4.3	128.9	131.7	130.3	6,370	6,400	12,770	90	90	180
1470N	5.93	6.4	-0.8	-0.3	-5.7	1.4	-4.7	4.3	128.3	129.2	128.8	6,410	6,170	12,580	90	80	170
1480S	8.05	6.3	-0.3	0.2	-5.7	1.3	-4.7	4.3	126.8	130.9	128.8	6,100	6,280	12,380	80	90	170
	6.98	6.4									129.2			12,580			170
1300N	7.93	8.3	-0.1	0.4	-0.8	-1.7	0.5	0.8	158.7	158.7	158.7	9,780	10,680	20,460	160	180	340
1310S	8.76	8.3	0.3	0.7	-1.4	-1.1	-0.1	1.5	159.1	159.5	159.3	9,840	10,880	20,720	165	180	345
	8.35	8.3									159.0			20,590			345
1330S	9.83	7.9	-2.0	0.5	-3.9	-4.5	1.9	2.9	191.7	195.9	193.8	15,400	17,440	32,840	310	355	665
1340N	8.90	7.6	-2.3	-0.1	-3.9	-4.5	1.9	2.9	191.5	196.2	193.9	15,250	17,550	32,800	305	360	665
1350S	9.85	7.8	-1.6	0.1	-4.6	-3.7	-0.6	1.7	191.0	196.2	193.6	15,250	17,590	32,840	305	360	665
	9.37	7.7									193.8			32,820			665
1360S	13.39	10.1	0.3	0.4	-2.2	-2.2	7.7	9.7	231.3	227.1	229.2	20,270	21,310	41,580	490	510	1000
1370N	12.25	10.4	0	0.8	-1.7	-3.1	8.6	9.3	230.9	227.6	229.3	20,120	21,580	41,700	485	515	1000
1380S	13.53	10.6	0.3	-0.1	-2.8	-2.1	7.6	10.3	231.2	228.1	229.6	20,230	21,680	41,910	490	520	1010
	12.86	10.4									229.3			41,720			1000
1390N	13.94	12.8	-0.8	1.1	-1.0	-3.5	5.0	4.0	268.3	272.5	270.4	27,100	30,740	57,840	760	875	1635
1400S	15.55	11.9	-0.6	-0.1	-2.0	-2.5	4.0	5.1	269.1	273.2	271.2	27,100	30,980	58,080	765	885	1650
1410N	13.86	12.3	-0.6	-0.6	-2.0	-2.4	4.0	5.1	268.3	271.9	270.2	27,100	31,060	58,160	760	885	1645
	14.73	12.2									270.7			58,040			1645
1420S	18.89	14.2	-2.3	-0.5	-2.3	-2.2	-1.1	0.5	318.2	319.8	319.0	36,850	39,740	76,590	1225	1330	2555
1430N	17.01	15.0	-2.6	-1.7	-2.4	-2.3	-1.2	0.4	316.6	317.8	317.2	37,200	39.950	77,150	1235	1330	2565
1440S	18.90	14.0	-2.6	-0.2	-2.4	-2.3	-1.1	0.4	319.8	320.7	320.2	37,420	39,790	77,210	1250	1340	2590
	17.95	14.6									318.4			77,020			2570

* + Trailing Edge Up
- Trailing Edge Down
} Canard and Stabilizer Flap Angles

+ Bow Up
- Bow Down
} Pitch

+ Stbd Roll
- Port Roll

TABLE 19 - SUMMARY OF VIDEO-TAPED DRAFT READINGS

Run	Mini-ranger Speed (knots)	Static Draft		Running Draft		Average Operational Trim*	
		Forward Reading ft (m)	Aft Reading ft (m)	Forward Reading ft (m)	Aft Reading ft (m)	Video Tape deg	Stable Table deg
19 Sep 79 Displacement = 237.1 Tons (240.9 Metric Tons) Calm Water, Fixed Control Surfaces, 0° Static Trim							
011S	4.87	16.86 (5.14)	16.83 (5.13)	16.50 (5.03)	16.50 (5.03)	0	-0.2
020N	4.49			16.50 (5.03)	16.75 (5.11)	0.57	0.4
040S	8.46			16.83 (5.13)	16.25 (4.95)	-0.57	-0.5
050N	7.55			16.50 (5.03)	16.50 (5.03)	0	0
060S	8.37			16.67 (5.08)	16.83 (5.13)	0	-0.5
070N	9.65			16.83 (5.13)	17.00 (5.18)	-0.29	0
080S	9.92			17.25 (5.26)	17.25 (5.26)	0	-0.6
100N	12.99			17.00 (5.18)	16.75 (5.11)	0.29	-1.3
110S	13.34			17.50 (5.33)	16.50 (5.03)	1.14	-1.2
130N	14.90			16.50 (5.03)	15.50 (4.72)	1.14	0.2
140S	15.10			16.75 (5.11)	15.75 (4.80)	1.14	-0.1
190N	17.44			16.75 (5.11)	16.75 (5.11)	0	0.1
200S	17.58			16.50 (5.03)	16.50 (5.03)	0	-0.4
20 Sep 79 Displacement = 237.8 Tons (241.6 Metric Tons) Calm Water, Fixed Control Surfaces, 1.78° Static Trim by the Stern							
230S	7.68	16.19 (4.93)	17.75 (5.41)	15.50 (4.72)	16.75 (5.11)	-1.14	1.3
240N	7.65			15.50 (4.72)	16.75 (5.11)	-1.43	1.8
250S	9.72			16.00 (4.88)	17.25 (5.26)	1.43	1.5
260N	9.58			15.75 (4.80)	17.50 (5.33)	2.00	2.0
280S	13.02			16.00 (4.88)	15.75 (4.80)	-0.29	1.8
290N	12.65			15.75 (4.80)	16.00 (4.88)	0.29	1.9
300S	14.60			16.00 (4.88)	16.00 (4.88)	0	2.1
310N	14.31			15.50 (4.72)	15.75 (4.80)	0.57	2.6
320S	17.67			15.75 (4.80)	15.50 (4.72)	1.14	1.9
330N	17.27			15.75 (4.80)	16.00 (4.88)	-0.57	2.6
340S	15.18			17.50 (5.33)	16.50 (5.03)	-1.14	-1.9
350N	14.78			17.00 (5.18)	16.50 (5.03)	-0.57	-1.3

* + Bow Up
  - Bow Down } Pitch

TABLE 19 (Continued)

Run	Mini-ranger Speed (knots)	Static Draft		Running Draft		Average Operational Trim*	
		Forward Reading ft (m)	Aft Reading ft (m)	Forward Reading ft (m)	Aft Reading ft (m)	Video Tape deg	Stable Table deg
21 Sep 79 Displacement = 217.4 Tons (220.9 Metric Tons) Calm Water, Fixed Control Surfaces, 2.91° Static Trim by the Stern							
360N	8.82	12.58(3.83)	15.13 (4.61)	14.00 (4.27)	13.50 (4.11)	-0.57	-0.6
390S	7.77	↓	↓	14.00 (4.27)	13.50 (4.11)	-0.57	0
400N	8.86	↓	↓	14.50 (4.42)	13.50 (4.11)	-1.14	0.2
560S	11.45	↓	↓	16.00 (4.88)	13.50 (4.11)	-2.85	-0.8
570N	9.25	↓	↓	14.00 (4.27)	14.00 (4.27)	0	0.6
580S	9.69	↓	↓	14.25 (4.34)	14.25 (4.34)	0	-0.1
430S	11.17	↓	↓	15.00 (4.57)	13.25 (4.04)	-2.00	-0.8
440N	12.19	↓	↓	15.00 (4.57)	13.25 (4.04)	-2.00	-0.5
470S	11.64	↓	↓	14.50 (4.42)	13.50 (4.11)	-1.14	-0.5
480N	13.05	↓	↓	14.75 (4.50)	12.50 (3.81)	-2.57	-0.3
500S	13.77	↓	↓	15.50 (4.72)	13.75 (4.19)	-2.57	-0.7
510N	13.15	↓	↓	15.25 (4.65)	13.25 (4.04)	-2.28	-0.1
520N	14.90	↓	↓	15.25 (4.65)	13.25 (4.04)	-2.28	0.3
530S	15.67	↓	↓	15.50 (4.72)	13.00 (3.96)	-2.85	-0.8
540N	17.18	↓	↓	15.25 (4.65)	14.25 (4.34)	-1.14	0.7
550S	18.47	↓	↓	15.50 (4.72)	14.25 (4.34)	-1.43	-
21 Sep 79 Displacement = 217.4 Tons (220.9 Metric Tons) Calm Water, 0 Deg Control Surfaces, 2.91° Static Trim by the Stern							
370N	8.75	12.58 (3.83)	15.13 (4.61)	14.50 (4.42)	13.00 (3.96)	-1.71	-1.4
380S	8.07	↓	↓	14.50 (4.42)	13.50 (4.11)	-1.14	-1.9
410N	8.94	↓	↓	15.00 (4.57)	13.50 (4.11)	-1.71	-1.4
420S	11.36	↓	↓	15.00 (4.57)	13.25 (4.04)	-2.00	0.2
450N	12.30	↓	↓	15.00 (4.57)	13.25 (4.04)	-3.14	-1.4
460S	11.56	↓	↓	15.50 (4.72)	13.00 (3.96)	-2.85	-3.2
* + Bow Up - Bow Down } Pitch							

TABLE 19 (Continued)

Run	Mini-ranger Speed (knots)	Static Draft		Running Draft		Average Operational Trim*	
		Forward Reading ft (m)	Aft Reading ft (m)	Forward Reading ft (m)	Aft Reading ft (m)	Video Tape deg	Stable Table deg
25 Sep 79 Displacement = 237.8 Tons (241.6 Metric Tons) Calm Water, Automatic Control System, 0.41° Static Trim by the Stern							
730S	7.86	16.79 (5.12)	17.15 (5.23)	16.50 (5.03)	15.50 (4.72)	-1.14	-0.5
740N	6.03			16.50 (5.03)	16.50 (5.03)	0	-0.1
590S	7.60			16.50 (5.03)	16.50 (5.03)	0	-0.4
600N	7.61			16.50 (5.03)	16.25 (4.95)	-0.29	-0.2
610S	10.34			16.50 (5.03)	16.75 (5.11)	0.29	0.1
620N	9.19			16.50 (5.03)	16.50 (5.03)	0	0.2
630S	10.38			16.25 (4.95)	17.00 (5.18)	0.86	0.3
650N	12.24			16.50 (5.03)	14.50 (4.42)	-2.28	-0.5
660S	13.58			16.00 (4.88)	15.50 (4.72)	-0.57	-0.5
670N	12.23			16.00 (4.88)	15.00 (4.57)	-1.14	-0.1
680N	13.98			16.00 (4.88)	14.75 (4.50)	-1.43	0
690S	15.93			16.50 (5.03)	15.00 (4.57)	-1.71	-0.3
700N	14.74			16.50 (5.03)	15.25 (4.65)	-1.43	0.1
710S	17.83			15.75 (4.80)	15.50 (4.72)	-0.29	0.1
720N	17.32			16.00 (4.88)	15.50 (4.72)	-0.57	0.5
27 Sep 79 Displacement = 228.4 Tons (232.1 Metric Tons) Rough Water, Automatic Control System, 2.92° Static Trim by the Stern							
750	7.46	14.25 (4.34)	16.81 (5.12)	15.00 (4.57)	15.00 (4.57)		
760	7.81			14.50 (4.42)	14.75 (4.50)		
770	8.24			15.50 (4.72)	14.50 (4.42)		
780	8.53			15.50 (4.72)	14.50 (4.42)		
790	8.22			15.50 (4.72)	15.00 (4.57)		
800	7.53			15.00 (4.57)	15.00 (4.57)		
1040	8.83			15.00 (4.57)	15.00 (4.57)		
1050	10.21			14.50 (4.42)	15.00 (4.57)		

* + Bow Up, - Bow Down } Pitch

TABLE 19 (Continued)

Run	Mini-ranger Speed (knots)	Static Draft		Running Draft	
		Forward Reading ft (m)	Aft Reading ft (m)	Forward Reading ft (m)	Aft Reading ft (m)
810	11.16			15.00 (4.57)	15.00 (4.57)
820	12.19			15.00 (4.57)	14.75 (4.50)
830	12.65			15.00 (4.57)	14.75 (4.50)
840	13.00			15.50 (4.72)	14.75 (4.50)
850	13.06			15.00 (4.57)	15.00 (4.57)
860	11.96			15.00 (4.57)	14.50 (4.42)
870	13.67			15.00 (4.57)	14.50 (4.42)
880	14.46			15.00 (4.57)	14.75 (4.50)
890	14.93			15.50 (4.72)	14.75 (4.50)
900	15.50			15.50 (4.72)	14.50 (4.42)
910	16.26			14.75 (4.50)	14.75 (4.50)
920	14.13			15.00 (4.57)	14.50 (4.42)
1020	15.18			15.25 (4.65)	15.00 (4.57)
1030	14.62			15.00 (4.57)	14.50 (4.42)
930	16.85			15.75 (4.80)	14.25 (4.34)
940	17.40			16.00 (4.88)	14.25 (4.34)
950	18.32			15.75 (4.80)	14.25 (4.34)
960	19.53			16.00 (4.88)	14.50 (4.42)
970	19.50			15.50 (4.72)	15.00 (4.57)
980	17.34			15.75 (4.80)	14.75 (4.50)
990	17.52			15.50 (4.72)	14.75 (4.50)
1000	18.01			15.25 (4.65)	14.25 (4.34)
28 Sep 79 Displacement = 215.0 Tons (218.4 Metric Tons) Rough Water, Fixed Control Surfaces, 2.00° Static Trim by the Stern					
1060	7.94	12.63 (3.85)	14.38 (4.38)	14.00 (4.27)	12.50 (3.81)
1070	9.10			14.00 (4.27)	12.50 (3.81)
1080	9.06			13.75 (4.19)	13.00 (3.96)
1090	8.13			13.75 (4.19)	12.75 (3.89)

TABLE 19 (Continued)

Run	Mini-ranger Speed (knots)	Static Draft		Running Draft		Average Operational Trim*	
		Forward Reading ft (m)	Aft Reading ft (m)	Forward Reading ft (m)	Aft Reading ft (m)	Video Tape deg	Stable Table deg
1100	8.85			14.00 (4.27)	13.25 (4.04)		
1110	10.03			14.00 (4.27)	13.25 (4.04)		
1120	10.05			13.75 (4.19)	13.25 (4.04)		
1130	8.95			13.75 (4.19)	13.25 (4.04)		
1140	11.37			14.00 (4.27)	13.00 (3.96)		
1150	12.37			13.88 (4.23)	12.00 (3.66)		
1160	12.01			14.00 (4.27)	12.25 (3.73)		
1170	11.23			14.00 (4.27)	12.00 (3.66)		
1180	12.69			13.75 (4.19)	11.50 (3.51)		
1190	13.86			14.00 (4.27)	11.50 (3.51)		
1200	13.76			14.00 (4.27)	11.50 (3.51)		
1210	12.76			14.00 (4.27)	11.50 (3.51)		
1220	14.54			14.00 (4.27)	11.50 (3.51)		
1230	15.60			14.50 (4.42)	12.00 (3.66)		
1240	15.56			14.00 (4.27)	11.50 (3.51)		
1250	14.52			14.50 (4.42)	11.50 (3.51)		
1260	17.05			14.00 (4.27)	11.75 (3.58)		
1270	18.03			14.50 (4.42)	12.75 (3.89)		
1280	17.68			14.25 (4.34)	12.00 (3.66)		
1290	17.02			14.75 (4.50)	12.00 (3.66)		
2 Oct 79 Displacement = 226.7 Tons (230.3 Metric Tons) Calm Water, Fixed Control Surfaces, 2.81° Static Trim by the Stern							
1460S	8.02	14.00 (4.27)	16.46 (5.02)	15.50 (4.72)	14.50 (4.42)	-1.14	-0.2
1470N	5.93			15.50 (4.72)	14.50 (4.42)	-1.14	0.3
1480S	8.05			15.50 (4.72)	14.50 (4.42)	-1.14	-0.2
1300N	7.93			15.50 (4.72)	14.50 (4.42)	-1.14	-0.5
1310S	8.76			15.75 (4.80)	14.50 (4.42)	-1.43	-0.9
* + Bow Up - Bow Down } Pitch							

TABLE 19 (Continued)

Run	Mini-ranger Speed (knots)	Static Draft		Running Draft		Average Operational Trim*	
		Forward Reading ft (m)	Aft Reading ft (m)	Forward Reading ft (m)	Aft Reading ft (m)	Video Tape deg	Stable Table deg
1320N	11.26			15.00 (4.57)	14.00 (4.27)	-1.14	-1.1
1330S	9.83			14.50 (4.42)	15.00 (4.57)	0.57	1.5
1340N	8.90			14.25 (4.34)	14.50 (4.42)	0.29	1.8
1350S	9.85			14.75 (4.50)	14.75 (4.50)	0	1.1
1360S	13.39			15.25 (4.65)	14.25 (4.34)	-1.14	-0.8
1370N	12.25			15.50 (4.72)	14.00 (4.27)	-1.71	-0.5
1380S	13.53			15.50 (4.72)	14.00 (4.27)	-1.71	-0.8
1390N	13.94			15.25 (4.65)	14.00 (4.27)	-1.43	0.2
1400S	15.55			15.25 (4.65)	13.75 (4.19)	-1.71	0.1
1410N	13.86			15.50 (4.72)	13.75 (4.19)	-2.00	0.1
1420S	18.89			14.25 (4.34)	12.75 (3.89)	-1.71	1.7
1430N	17.01			14.25 (4.34)	13.25 (4.04)	-1.14	2.1
1440S	18.90			14.00 (4.27)	12.75 (3.89)	-1.43	2.0

* + Bow Up
  - Bow Down } Pitch

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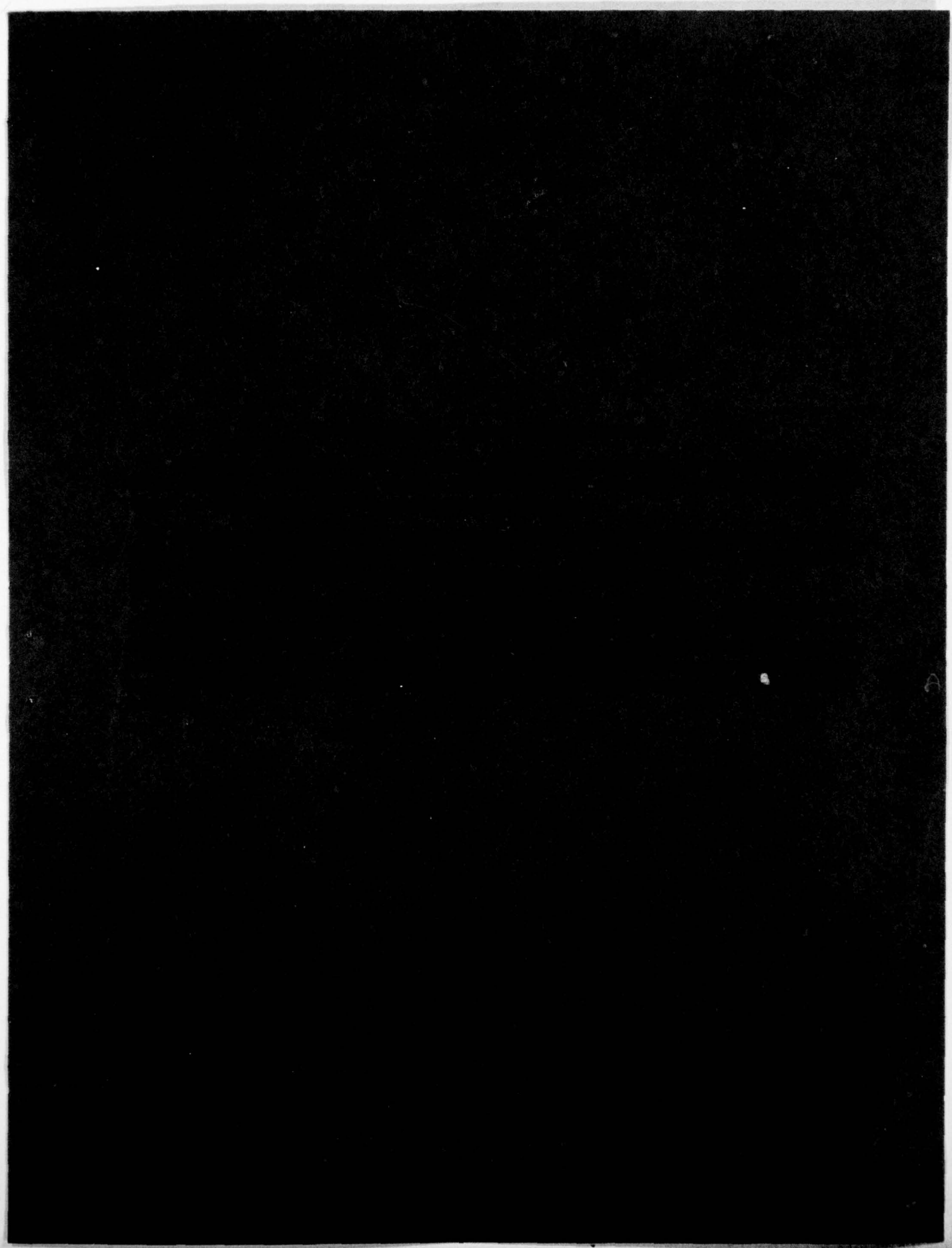

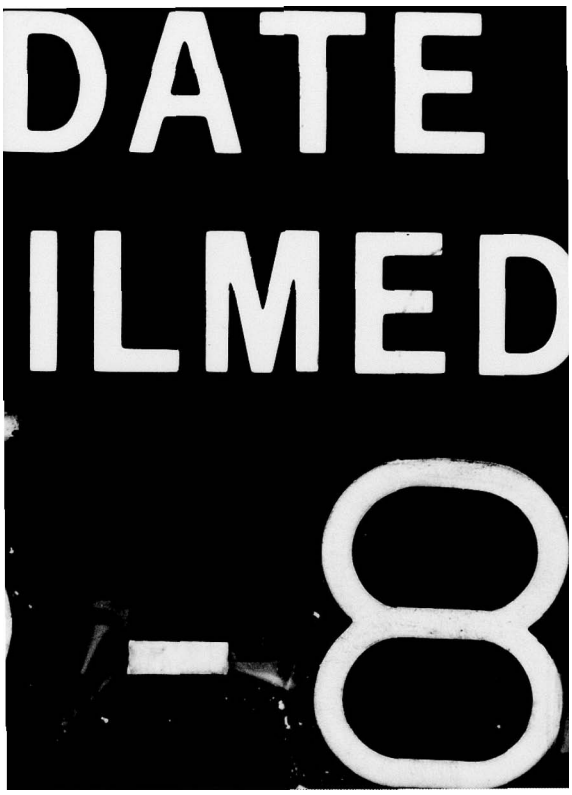
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